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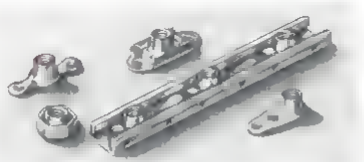

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Navy reveals amazing details of airship all-weather endurance flight test

On January 14th, the Naval Air Development Unit at South Weymouth, Massachusetts, working closely with Airship A.E.W. Squadron No. 1 of Lakehurst, N. J., assigned four Goodyear-built ZPG-type blimps *to 10 continuous days and nights* of radar sentinel duty over the storm-tossed North Atlantic.

On January 25th, the last airship reported back to its air dock — the group having established a weather endurance record unparalleled in the history of flight.

For ten days, working as a team, these latest airships maintained uninterrupted radar patrol of the sea approaches to the nation's northeast coast — flying the assigned area in spite of weather which included a 37-hour blizzard, severe icing conditions, and long spells of "zero zero" visibility, over seas whipped by 60 knot winter gales.

It is convincing proof of the increasing importance of the role the airship is destined to play — in defending the nation which has sole control of the nonflammable helium that makes the modern lighter-than-air craft possible.

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AVIATION CALENDAR

Apr 2-5—National Aeronautic Meeting, Aeronautic Production Forum and Aircraft Engineering Display sponsored by Society of Automotive Engineers Hotel Commodore New York.

Apr 3-6—Spring Meeting American Rocket Society, Sheraton Park Hotel, Washington D C

Apr 7-10—Spring Meeting American Society of Mechanical Engineers, Dinkler Tutwiler Hotel, Birmingham, Ala

Apr 9-11—Fifth Welding Show, Sheraton Hotel Philadelphia Pa

Apr 10—Auction of surplus aircraft hardware electrical and electronic parts metals 10 30 a m Grumman Aircraft Engineering Corp Warehouse Bldg 12 Farmingdale, L I N Y

Apr 10-12—National Nuclear Instrumentation Conference and Third Southeastern Industrial Instrumentation Exhibit Atlanta Biltmore Hotel Atlanta Ga

Apr 12—Latest Developments in Capsule Escape Systems Douglas Aircraft Co and Society of the Experimental Test Pilots, Lancaster Calif

Apr 14-16—1957 National Symposium on Telemetering sponsored by the Institute of Radio Engineers' Professional Group on Telemetry and Remote Control, Sheraton Hotel Philadelphia Pa

Apr 15-17—Symposium on Systems for Information Retrieval sponsored by Western Reserve University, Masonic Auditorium Cleveland, Ohio

Apr 16-17—Aircraft Ball Bearing Conference, sponsored by New Departure Division General Motors Corp Statler Hotel Hartford Conn

Apr 16-18—Symposium on Nuclear Tests for Nondestructive Testing Morrison Hotel, Chicago, Ill

Apr 22-24—Second Annual Jet Engine Hydraulics Symposium Hotel Statler, Detroit Mich

Apr 23-25—Annual Convention International Airline Navigators Council, Piccadilly Hotel, New York

(Continued on page 6)

AVIATION WEEK • APRIL 1, 1957

Vol. 66 No 13

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Apr. 29—Third Flight Test Instrumentation Symposium, Statler Hotel, Los Angeles.

Apr. 29-May 2—16th Annual National Conference, Society of Aeronautical Weight Engineers, Broadview Hotel, Wichita, Kans.

Apr. 30—Atlantic Rate Commodity Rate Board Meeting, International Air Transport Assn., Torquay, Devonshire, England.

May 1-3—Spring Meeting and Exhibit, Society for Experimental Stress Analysis, Hotel Statler, Boston, Mass.

May 5-8—1957 Convention, American Association of Airport Executives, Shamrock Hilton Hotel, Houston, Tex.

May 6-8—28th Annual Meeting, Aero Medical Assn., Shirley Savoy Hotel, Denver, Colo.

May 8-11—13th Annual National Forum, American Helicopter Society, Sheraton Park Hotel, Washington, D. C.

May 13-15—National Conference on Aeronautical Electronics, Sponsored by the Institute of Radio Engineers, Dayton, Ohio.

May 15-17—Jet Age Airport Conference, Air Transport Division, American Society of Civil Engineers, Park Sheraton Hotel, New York.

May 24-June 2—22nd Paris Air Show, Society of French Aircraft Constructors, Le Bourget Airport, Paris.

June 1—8th Annual Maintenance and Operations Meeting for Business and Executive Aircraft Owners, sponsored by Reading Aviation Service, Reading Municipal Airport, Pa.

June 1-9—First Annual National Aviation Trade Show, Monmouth County (N. J.) Airport.

June 7-8—30th Annual Homecoming and Reunion, Parks College, East St. Louis, Ill.

June 17-20—National Summer Meeting, Institute of the Aeronautical Sciences, Biltmore Hotel, Los Angeles, Calif.

June 23-25—29th Annual Meeting, Aviation Distributors & Manufacturers Assn., The Broadmoor, Colorado Springs, Colo.

July 2-11—24th National Soaring Contest, Elmira, N. Y.

July 12-13—British Lockheed International Aerobatic Competition, the National Air Races (third round) and the King's Cup Air Race, Circuit of, Civil Aerodrome, Bagington, England.

Aug. 20-23—Western Electronic Show & Convention, Board of Directors, Cow Palace, San Francisco, Calif.

Sept. 1-6—Sixth International Aeronautical Conference, Royal Aeronautical Society and Institute of the Aeronautical Sciences, Folkstone and London, England.

Sept. 2-8—1957 Flying Display, Society of British Aircraft Constructors, Farnborough, England.

Nov. 7-8—Weapons System Management Meeting, Statler-Hilton Hotel, Dallas, Tex.

Dec. 17—Wright Brothers Lecture, Department of Commerce Auditorium, Washington, D. C.

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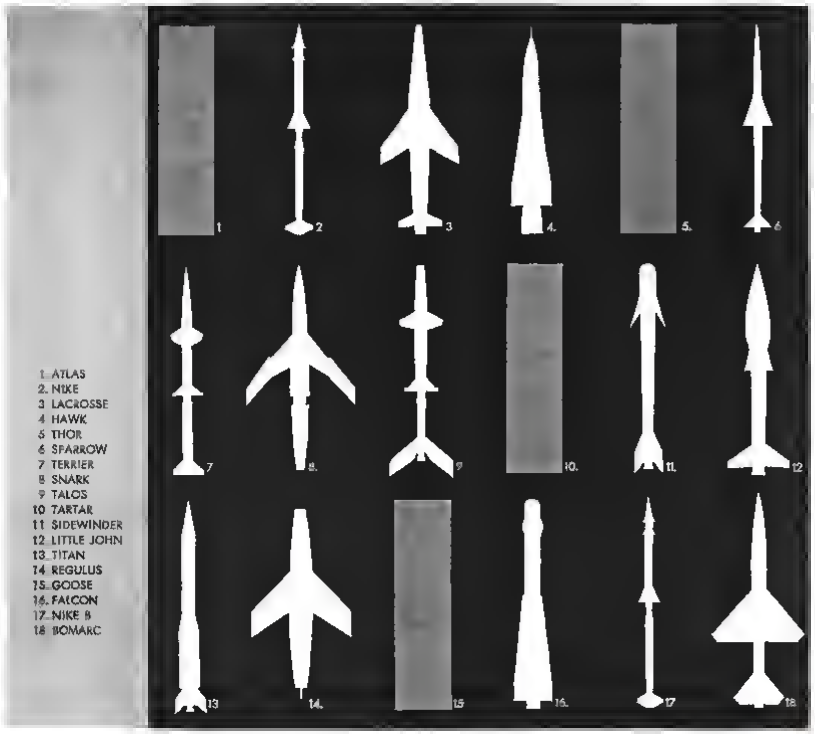

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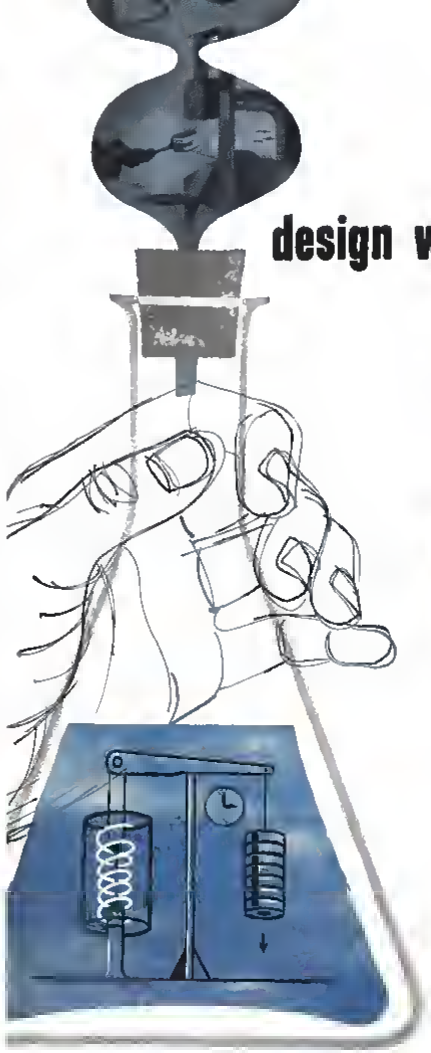

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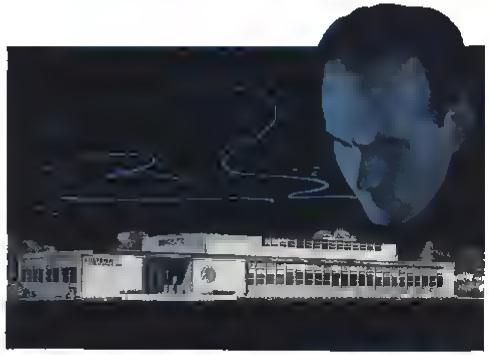

New **microcast** *Research Facilities will increase investment casting applications and give design engineers greater latitude in planning parts.*

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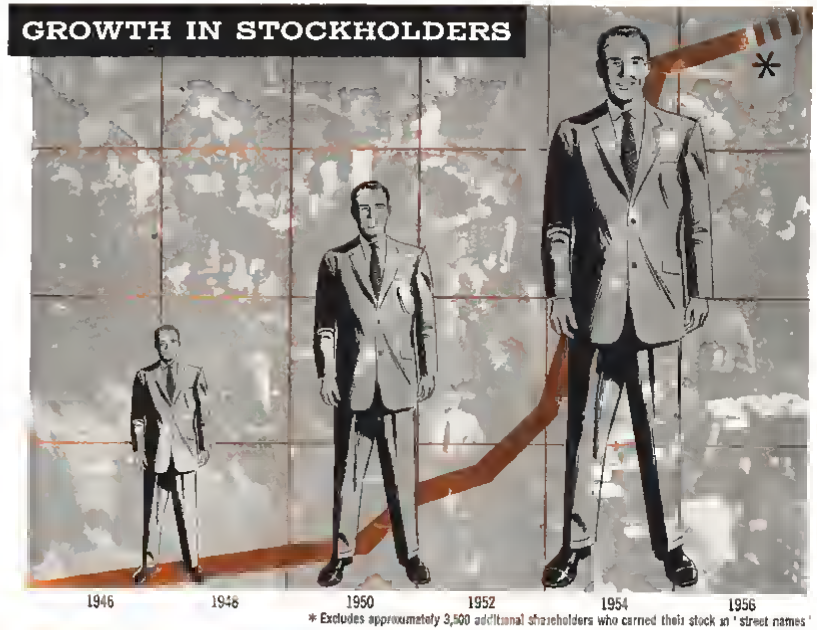

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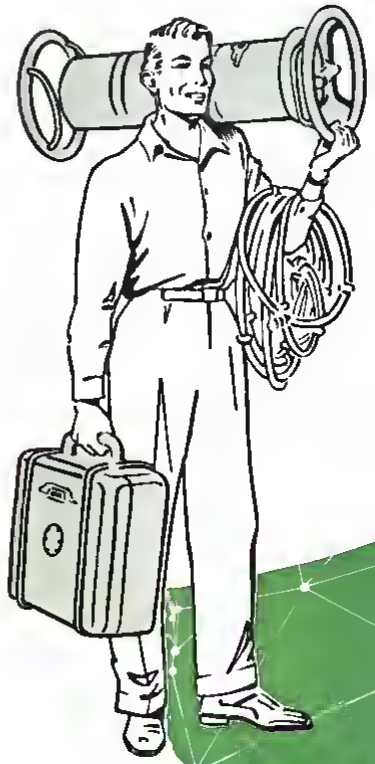

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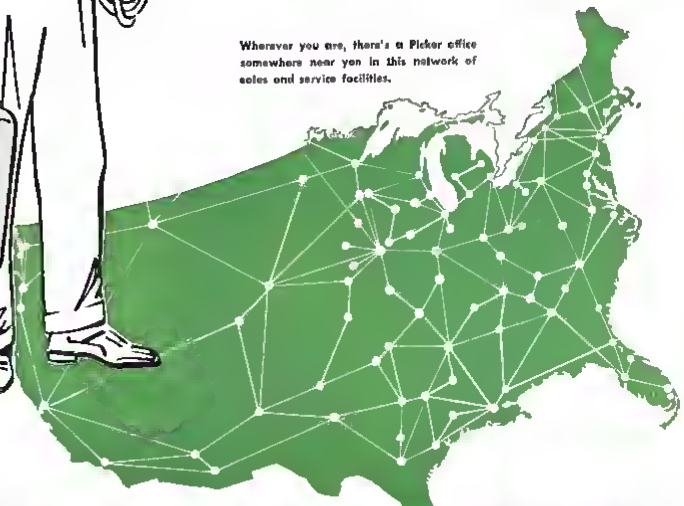

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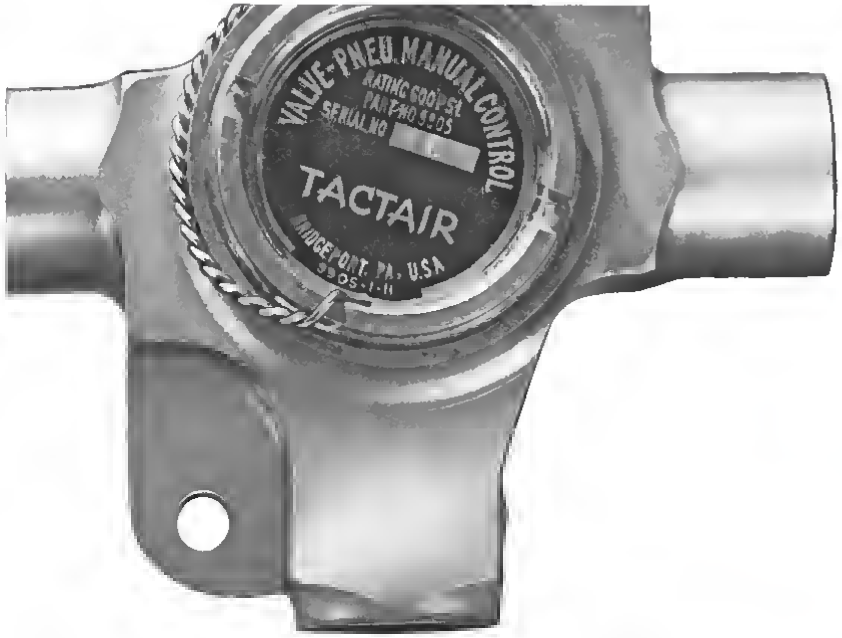

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COVER: Prototype of de Havilland Comet 4, nicknamed Comet 3½, uses auxiliary power source to start engines on ramp at Hatfield Airport, Hertfordshire, England. Aircraft which has control system modified for artificial feel, will be used on preliminary flight trials on test cargo runs between London and Rome by BOAC. Capital Airlines has four Comet 4s and 10 Comet 4As; BOAC 19 Comet 4s on order. Comet 3½ has detachable wingtips to convert it into the 115 ft. span Comet 4 or the 108 ft. span short range Comet 4A. In addition to fuselage strengthening, deicing system has been improved and flight deck is rearranged for greater crew comfort. Powerplants are Rolls-Royce Avon RA. 29s, which will power Comet 4s.

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Member ABP and ABC

Good Air Force Appointments

Top leadership of the U S Air Force has been strengthened substantially by the appointment of General Thomas D White as chief of staff and the elevation of Undersecretary James H Douglas to be secretary. It is also gratifying to see General Nathan F Twining become the first USAF officer to serve as chairman of the Joint Chiefs of Staff.

Mr. Douglas comes to his new post with a wealth of experience and a solid record of proven performance in USAF affairs. He served as a commissioned officer in the Army Air Forces during World War II and considerable of his civilian legal practice involved commercial airlines.

For the past four years he has been the unsung work horse of the USAF secretariat.

Able Advocate

Mr. Douglas has been perfectly content to let others bask in the limelight, make the public speeches and acquire the kudos that go with high public office. He has been content to remain in the background and do the hard, effective work necessary to keep USAF from being smothered in the sea of Pentagon red tape. The list of knotty inter-service problems where Mr. Douglas has ably upheld the USAF position during the past four years is too long to be detailed here. Perhaps it comes from his legal experience but Mr. Douglas is also extremely persuasive in convincing others outside USAF to appreciate its position in these inter-service affairs.

There is no doubt that USAF is getting a devoted and able advocate in Mr. Douglas. He has worn its uniform in time of war and served it well through Pentagon battles.

He will be, as every USAF secretary of course should be, a staunch partisan of USAF, fighting hard for the things it needs to discharge its responsibility to the nation and defending it stoutly against the false prophets of unsound military or fiscal policies.

Global Air Leader

General White has had excellent preparation for his new post in the years he served as vice chief of staff to General Twining. He is the type of broad gauge leader, whose experience goes far beyond being an excellent air plane driver, that USAF now needs to manage and direct its immense and still growing global responsibilities. Seldom in the history of the world—we have to go back to the British navy in the 19th Century for another example—has a single military force been such a vital factor in preserving the balance of peace in this troubled world.

General White has had foreign diplomatic service as an air attache in Europe, Asia, South America and, most important, Russia. He speaks several languages and thinks in the long ranging strides of modern air technology.

The accession of Mr. Douglas and General White to the top USAF posts is but a part of another major game of Pentagon musical chairs that will see far reaching changes in both USAF and the Secretary of Defense's establishment. It appears that General Curtis Emerson LeMay will relinquish his long command of Strategic Air Command and move into the Pentagon as vice chief of staff to General White. This may be firm indication that he will eventually become chief of staff since the last three vice chiefs have eventually moved up to the top spot.

Major Shake-Ups Caming

General LeMay's arrival in the Pentagon portends some major shake-ups in USAF plans and policies—some of them long overdue. Another major shift will see Lt Gen C S Irvine, an extremely able and dedicated USAF officer who combines a rare pilot's skill with an expert knowledge of the materiel business, move to Dayton to head the Air Materiel Command. General Edwin Rawlings, another extremely able USAF manager during his long tenure as chief of AMC, appears headed for a top spot in Europe.

There are also rumblings that the long overdue major overhaul of the Defense Department is not far off. Nobody concerned with the defense problem has been happy over the way inter-service problems have been handled, the tremendous growth of the overhead in the Secretary of Defense's establishment, and the failure to achieve real economy in meeting the nation's defense requirements.

Who will be given this task and just what his approach will be are still matters of speculation. But it is certain that the attempt will be made soon.

—Robert Hotz

WHO'S WHERE

In the Front Office

John C Virden, board chairman, Eaton Manufacturing Co., Cleveland, Ohio. Mr Virden, who will continue as president, succeeds **Howard J McGinn,** who will continue as a director and executive committee member.

Neele E. Searns, board chairman, and **Dale A. Lichty,** president, Hydro-Aire, Inc., Burbank, Calif.

George P. Brubaker, president, Telecomputing Corp., Van Nuys, Calif.

A. J. Williamson, president, Tube Reducing Corp., Wallington, N. J.

Shepard Spink, vice president merchandising, American Airlines, Inc.

William Ernig, vice president and treasurer, Wilford Aircraft Corp., Merion Station, Pa.

Thomas K. Foster, vice president, Acro Corp., Atlanta, Ga.

C. M. Donahue and **E. W. Merry,** group vice presidents, Mine Safety Appliances Co., Pittsburgh, Pa.

Ludwig H. Clifton, vice president and comptroller, Pan American Grace Airways, Inc.

Andrew B. Pulham, vice president and general manager, Marvel-Schebler Products Division, Borg Warner Corp., Chicago, Ill.

T. R. Pierpoint, head, Washington, D. C. office, Vertol Aircraft Corp., Morton, Pa. Mr. Pierpoint succeeds **Lawrence E. Williams,** retired.

Dr. Nicholas J. Hoff, professor and active head, newly established Division of Aeronautical Engineering, Stanford University, Stanford, Calif.

Honors and Elections

Dr. Jerome C. Hunsaker, member and former chairman of the National Advisory Committee for Aeronautics, has received the NACA's highest award, the Distinguished Service Medal. The NACA cited Dr. Hunsaker for "service of fundamental significance to aeronautical science, climaxed by an outstanding and unparalleled record of leadership during the past 15 years [illegible]."

Paul A. Schweizer, of Schweizer Aircraft Corp., has been elected president of the Soaring Society of America, Inc. Other newly elected officers are **Stanley W. Smith,** of Bell Aircraft Corp., and **William S. Ivans,** of Convair, vice presidents. **Maj. William R. Fuchs,** of the USAF Academy, secretary; **Dr. Harnet Selvadge,** of Bendix, treasurer.

Changes

Charles Bodey, chief engineer, Southwestern Industries, Inc., Los Angeles, Calif.

V. L. Brown, space control manager (Denver, Colo.), United Air Lines, Inc.

Paul J. Glaser, superintendent, Detroit Wayne Major Airport, Detroit, Michigan.

Everett J. Long, assistant director operations and **James C. Kyle,** assistant director engineering, Transdirect Division, Consolidated Electrodynamics Corp., Pasadena, Calif.

(Continued on page 110)

INDUSTRY OBSERVER

► First static test firing of the Atlas intercontinental ballistic missile was made last week by Convair's Astronautics Division at a new facility in Sycamore Canyon near San Diego. The facility is especially designed for static missile checkouts. After test runs are completed at Sycamore, complete missiles can be shipped to the Air Force Missile Test Center at Patrick Air B., Fla., for launching.

► Navy's Chance Vought F8U-3, an improved version of the F8U-1 Crusader, will be powered by Pratt & Whitney's J75 turbojet engine rated at 15,000 lb. thrust. Aircraft is designed for speeds of approximately Mach 2 (AW Jan. 14, p. 23). Navy has awarded Pratt & Whitney a $72,597,330 contract for the J75. The engine also will be used to power production models of Martin's P6M SeaMaster and probably other Navy aircraft now in the design stage.

► Lack of funds has caused the Navy to mothball its project with Allison Division of General Motors Corp. to develop a third approach to an aircraft nuclear powerplant. USAF and the Atomic Energy Commission are sponsoring the other two approaches with General Electric Co. and Pratt & Whitney Aircraft. Navy's primary interest was in an atomic powered flying boat.

► Dassault has begun flight test program of its Etendard VI lightweight tactical fighter. Powered by a Bristol Orpheus turbojet, the Etendard VI is designed to land and takeoff from makeshift airfields and is a contender in NATO's lightweight fighter competition.

► Convair's Fort Worth Division has developed a new device for testing non-standard bonds in honeycomb sandwich panels, metal-to-metal bonds and other structural bonds. The new device, known as a Comdascope, is a practical application of the STUB meter, a testing device developed by Sanford Research Laboratory. Comdascope has been licensed to Almar-York Co., of Fort Worth, for manufacture and general sale.

► Army has canceled anti-missile defense system study under Project Plato at Cornell Aeronautical Laboratory. Another research and development project on an anti-missile weapon system is being continued.

► Army and Navy are sponsoring extrapolations of the Lacrosse close-support missile for other applications. One possible application of the Martin missile is for firing from ships in support of landing operations and from submarines. Lacrosse study began under a Marine requirement for a weapon to knock out hard-topped targets such as bunkers. Original Marine idea was for a weapon to be dropped or fired from a helicopter. Present missile system was evolved as the simplest in terms of logistic support and tactical use.

► Douglas Aircraft's El Segundo Division will set a production record for the Navy in 1957 with deliveries of more than 600 aircraft scheduled. El Segundo is producing the F4D all-weather fighter, the A4D lightweight atomic bomber and the A3D twin-jet carrier-based bomber.

► France's Leduc 022 ramjet-powered supersonic interceptor has completed 30 flights using only its Snecma Atar jet engine for propulsion. Tests using Leduc's ramjet are scheduled to begin next month. The aircraft, which made its first flight in December (AW Jan. 7, p. 23), will undergo tests aimed at Mach numbers up to 4.

► Ryan's X-13 jet VTOL aircraft uses an engine that gimbals approximately 15 degrees in vertical plane. X-13 also employs directionally controllable wingtip jets.

► Sud Aviation's Djinn turbine helicopter set a world's altitude record for helicopters by climbing to 8,482 meters—approximately 27,570 ft. Previous record was held by Sud Aviation Alouette which climbed to 8,229 meters in June, 1955.

Washington Roundup

Information Declassifier

Defense Department is organizing a new Office of Director of Declassification Policy with the assignment to cut the backlog of classified documents now on hand. The office, which also has been assigned the task of holding the volume of classified documents to a manageable level in the future, was authorized late last week in a series of directives partially implementing the recommendations of the Committee on Information Policy headed by Charles Coolidge (AW Nov. 19, p. 29). The directives issued by Defense Secretary Charles E. Wilson also:

- **Ban the use** of "Top Secret," "Secret" and "Confidential" on information classified for other than security reasons.
- **Reject the Coolidge proposal** that writers should be required to give the sources of their information to grand juries.

Double Savings

A statement by the House Armed Services Investigating Subcommittee headed by Rep. Edward Hebert (D.-La.) that the group's investigation of the airframe industry last year resulted in a refund to the government of $328 million by manufacturers conflicts with earlier testimony by the Air Force and Navy.

An announcement of the subcommittee's new investigation into the aircraft engine industry (see p. 26) read in part:

"Hebert disclosed for the first time that as a result of this investigation into the manufacturers of airframes, the government recovered $328 million from the aircraft industry."

Of this, the subcommittee said, $178 million was to USAF and $150 million to the Navy.

On March 20, 1956, during a subcommittee session, J. S. Tassin, assistant director of the Contracts Division of the Bureau of Aeronautics, publicly disclosed that BuAer had already recaptured its $150 million.

The following day, T. P. Gerrity, assistant for production programming, Office of the USAF Deputy Chief of Staff, Materiel, told the subcommittee that the Air Force had recouped its $178 million.

Increase Pay, Saves Money

Head of the Defense Advisory Committee on Professional and Technical Compensation says his proposals for military personnel pay increases could save the government as much as $5 billion a year.

Ralph J. Cordiner, committee chairman and president of General Electric Co., believes the present defense budget could be trimmed from $38 billion to $33 billion if his plan were already in effect. Key to the savings, Cordiner says, would be to shift the emphasis in determining pay from longevity of service to skill (AW Feb. 4, p. 37).

The committee chairman believes that, by putting the pay premium on technical skills and thus blocking the present flow of technical personnel from the military, the services could increase their combat effectiveness by 15%.

Then, he says, the services could decide whether to retain their higher effectives, which would result in a cost increase, or cut $5 billion from their spending by reducing manpower.

The committee chairman says Defense Secretary Wilson accepts the philosophy of the Cordiner plan, although the secretary has said that he won't go along with certain of the recommendations.

Congressional Investigations

Look for these congressional investigations and reports:

- **Northeast Airlines stock case.** The case heads the agenda of business of the Senate Permanent Investigating Subcommittee headed by Sen. John McClellan (D.-Ark.). As soon as McClellan's other duties—as chairman of the special committee investigating labor racketeering—permit, hearings will be held on the charge that a "leak" from the Civil Aeronautics Board on the award of a New York-Miami route to Northeast caused an overnight buying spree of the airline's stock.
- **Report of alleged monopolies** in air transportation by the House Judiciary Subcommittee headed by Rep. Emanuel Celler (D.-N. Y.). The group held extensive hearings last year, but the staff has laid the matter aside for other business, and the final report is still at least several weeks off.
- **Civil Aeronautics Board's** independence from White House control is expected to figure in a study of the operations of quasi-judicial agencies by a subcommittee of the House Commerce Committee headed by Rep. Morgan Moulder (D.-Mo.). The subcommittee's professional staff is now being organized.

Small Business Protest

Members of House Small Business Committee are protesting the membership of Defense Department's recently-organized Small Business Advisory Committee. Leader of the attack is Rep. James Roosevelt (D.-Calif.).

In a speech on the House floor, Roosevelt objected that only eight of the 18 industry members are small businessmen—representatives of firms with less than 500 employes. Six of the representatives, he said, are from the 100 top firms on volume of defense business. Four of the six are from aircraft companies: Boeing Airplane Co., North American Aviation, United Aircraft Corp., Lockheed Aircraft Corp.

Roosevelt charged that this membership is indicative of Defense Department's policy of leaving "the important task of spreading defense production almost entirely up to the discretion of the large contractors by means of such subcontracting as the large contractor finds it profitable or convenient to make. This, of course, places thousands of smaller concerns more and more at the mercy of a handful of giant companies with respect to how much subcontracting is done, with whom, and upon what terms and conditions."

Korea Bilateral

Prospects are good for an early and successful conclusion to final negotiations for an air bilateral agreement between the U. S. and Korea. Korean officials and representatives of the Korean National Airlines have been in Washington for the last three months negotiating with various U. S. officials and airline representatives. At present, the U. S. carrier—Northwest Airlines—operates between the U. S. and Korea, but no Korean airline operates to the U. S.

—Washington staff

New Procurement Probes Face Industry

Hebert subcommittee, General Accounting Office disclose plans for independent investigations.

By Katherine Johnsen

Washington—Blueprints were disclosed last week for two major investigations into military aviation procurement policies.

• Rep. Edward Hebert (D.-La.), chairman of the House Armed Services Investigating Subcommittee, said his group plans an "intensive probe" of 17 aircraft engine manufacturers that will "conservatively" result in savings to the government on "current fiscal year business alone" of $100 million.

• General Accounting Office's L. J. Powers, chief of GAO's Defense Accounting and Auditing Division, told AVIATION WEEK that the agency expects to investigate between 200 and 250 defense plants primarily in the aircraft and electronics fields, during the next year.

No 'Witchhunt'

Both investigations will emphasize contractor costs, as well as profits, including subcontracting practices, executive salaries, bonuses and other overhead expenses, accounting procedures and operating controls.

Both Hebert and Powers stressed that their policy will be to "work with" the military services and contractors. "Our review should not be called an 'investigation'—which implies a sort of witchhunt,' Powers said. Hebert also hopes his investigation will be considered constructive by the industry.

The Hebert subcommittee already has dispatched a comprehensive questionnaire to the 17 aircraft engine manufacturers. These will be studied by the subcommittee staff under the direction of Counsel John Courtney. After this the group will hold public hearings during June and July.

The investigation is, essentially, a continuation of the subcommittee's probe last year into the 12 major airframe manufacturers and will follow the same pattern. Factors that will highlight the study of the industry are:

• **Extent to which firms are government financed,** both in capital investment and through sales volume. In its report on the airframe industry last year (AW July 23, p. 28), the subcommittee took the position that the profits of firms whose preponderance of business is with the government should be considered as "management fees" and not be geared to the sales volume.

• **Rental policies** on government financed facilities. The subcommittee has argued that the government should take its return for the use of such facilities engaged in defense work in the form of reduced costs—and not in rental payments.

• **Distribution of profits.** The subcommittee will closely scrutinize dividend policies. The group has consistently urged that profits on defense business be ploughed back into new facilities required for defense production. The risk taken in investing in design competitions also will be studied.

• **Renegotiation policies.** The subcommittee has been particularly critical of the Renegotiation Board for its several years' backlog of unfinished business, a factor that has kept contractors in suspense as to their financial status.

• **Executive salaries.** The subcommittee will focus its attention on total executive salary bills, as well as individual salaries.

• **Employment of retired military personnel.** The subcommittee has endorsed the use of the specialized skills of former military officers by industry but criticized their employment for "influence" value.

GAO Investigation

The Defense Accounting and Auditing Division was recently organized to accelerate Government Accounting Office's investigations of defense procurement. Exploratory work indicated a serious need for this, according to Comptroller General Joseph Campbell (AW March 25, p. 25). Powers, the division's head, is a career government auditor.

GAO's contractor plant investigations will be conducted by the agencies' 19 regional offices under Powers' direction.

The agency plans to work in close cooperation with the Renegotiation Board. Powers told AVIATION WEEK that liaison already has been worked out at the Washington policy level and will soon be established regionally at the operating level.

The two basic objectives of the studies of defense plants, Powers said, will be to determine:

• **Efficiency of contractor operations**—including cost consciousness, overhead, inventory control, accounting procedures, operating controls.

• **Evaluation of types of contracts** and contract terms and the adequacy of audits by the military services.

The GAO investigations will focus primarily upon current business, rather than closed contracts. Powers said recommendations will be made periodically to congressional committees—the House and Senate Armed Services Committees, the Appropriations Committees and the Government Operations Committees.

The Hebert subcommittee investigation will cover the five-year period from 1952 through 1956.

The first part of the subcommittee's questionnaire to the 17 engine manufacturers requires comprehensive factual data on each specific contract for this period.

Hebert Questionnaire

The second part requires general company information, including:

• **For each of the five years,** the total sales volume, the volume of government sales, company net worth, amount of outstanding stock, dividends, amount of paid-in capital, amount of surplus.

• **Details on any renegotiations.**

• **Listing of all contributions** or dues paid to any trade, professional or promotional organization, and the consultation or advisory fees or salaries paid to outside organizations.

• **Year-by-year expenditures** for traveling, entertainment and selling purposes.

• **Salary and duties of all officials** earning over $25,000 a year and any compensation paid to a retired military officer.

• **Value and type of government** owned property used in defense production or private production.

• **Profits before and after taxes.**

Two of the 17 companies are not currently engaged in aircraft engine production: Buick Motor and Chevrolet Aviation Engines, both divisions of General Motors Corp. The subcommittee is reviewing their past contracts. The other 15 firms are:

• **Pratt and Whitney Aircraft Division,** United Aircraft Corp.
• **Westinghouse Electric Corp.**
• **Fairchild Engine and Airplane Corp.**
• **Boeing Airplane Co.**
• **General Electric Co.**
• **Allison Division, General Motors.**
• **Wright Aeronautical Division,** Curtiss-Wright Corp.
• **Air Cooled Motors.**
• **Ford Aircraft Engine Division,** Ford Motor Co.
• **Lycoming Division, Avco.**
• **Nash Kelvinator Corp.**
• **McCullough Motors Corp.**
• **Continental Aviation and Engineering Corp.**
• **Studebaker Packard Corp.**
• **Willys Motor Corp.**

In announcing the engine investigation, Hebert claimed that his subcommittee's investigation of the airframe industry resulted in a recovery of $328 million by the government. He added:

"I want to emphasize that the aircraft industry voluntarily returned to the federal treasury this huge sum of money immediately after the investigation began. This represents overpayments to the aircraft concerns by the two services. These are funds which the companies themselves felt were excessive."

Bell Completes Ranger for President Eisenhower

One of two Bell 47-J Ranger helicopters built for President Eisenhower's use is shown being flight tested at Ft. Worth, Tex. Designated H-13J the helicopters are destined for short hauls from the White House, carrying the President and Secret Service personnel. President's H-13J is custom-built to carry three passengers instead of the helicopter's normal capacity of five. According to White House sources, the Bell was chosen over larger types primarily because they were considered too noisy.

Ministry of Supply Accepts Air Criticism

London—Recommendations which could mean a virtual reorganization of the British aircraft industry have been accepted in principle by the Ministry of Supply.

"In particular, some consolidation of resources is desirable," Supply Minister Aubrey Jones told the House of Commons.

Jones said that in placing future contracts with the industry he will keep in mind the need to consolidate available resources. A parliamentary committee charged (AW Jan. 28, p. 26) that the number of military contracts previously overburdened resources of the industry.

Reduction in military orders is inevitable, Jones said, but he declined to comment on how extensive this reduction will be until completion of the defense review now underway.

Research Will Be Emphasized, Newbury Responds to Critics

By Claude Witze

Washington—Frank D. Newbury, bearing a new title and responsibilities as the Defense Department's chief of research and engineering, is launching a vigorous campaign to convince critics that his administration will place new emphasis upon scientific research.

Recognizing the apprehension of scientists concerned with the defense program (AW Mar. 18, p. 25), Newbury promised in his first formal meeting with the press that he will favor larger future appropriations for basic research. He said he also will press hard for more effective effort in this field.

Choice of Newbury, 76 and a retired engineer, for the new post and elimination of the old office of an Assistant Secretary for Research and Development, was widely criticized in scientific and industrial circles (AW Mar. 4, p. 26). His appointment was interpreted by most observers as final victory in his four-year battle to win cognizance over research in the Defense Department.

His effort in this line had been strongly opposed by the last two Defense research and development chiefs, Dr. Clifford C. Furnas, now chancellor of the University of Buffalo, and Donald A. Quarles, present Secretary of the Air Force.

Newbury's statements of policy followed Defense Secretary Charles E. Wilson in release of a new directive outlining responsibilities of the office.

The Wilson directive on Newbury's responsibilities (5129.1) gives him administrative direction over the Weapons Systems Evaluation Group, formerly administrated by the Assistant Secretary for Research and Development. Newbury said he wants to make sure WSEG gives more of its time to the problems of his office.

WSEG was established in 1948 to furnish top Defense officials "an independent and objective analysis of present weapons."

Other responsibilities include:

• **Insure that research programs** are "sound and integrated," "give appropriate emphasis to the basic and applied research" and use the best talents.

• **Assure that military equipment** is obtained with minimum types and sizes with lowest cost, effort and time and be of sound design with respect to producibility, reliability, mobility, ease of maintenance, etc.

• **Recommend assignment** of specific programs to military departments where it is justified.

• **Insure that adequate attention** be given to ease and economy of maintenance during the design and production

NATO Spending Plans

Paris—NATO will spend $630 mil lion in an infrastructure program to cover next four years. While no break down was given a large portion of the funds will be spent on construction of additional airfields and for financing a NATO forward scatter system and early warning radar network. New program brings to nearly $3 billion total amount earmarked by NATO on infrastructure program projects through 1961. These projects include already completed con struction of 150 airfields.

phases of weapons development
- Enhance the contribution of research, development and engineering programs to strategy through close liaison with the Joint Chiefs of Staff
- Promote conservation of materials

Boost Research, Cut Cost

Newbury, in his policy statement, said that, in time, he hopes it will be possible to increase the work in research with an application to the defense mis sion and, at the same time, cut down on the high cost of weapon systems in the development stage.

Most surprising of his statements was the guarded disclosure that he hopes to get the Defense Department itself into the position where it will award contracts for research work inde pendent of the three armed forces.

He made the suggestion with the reservation that this type of activity will be necessary in fields where his office finds a need for new ideas but where the Army, Navy and Air Force are un willing to spend money from their own limited budgets.

Newbury declined to give specific ex amples of the fields in which he thought such work might be needed but ac knowledged interest in such matters as cosmic rays and high-temperature metals.

Vanguard 'Borderline'

On the other hand, he said he con siders it of little importance to the de fense effort whether the U. S. or some other power takes the first picture of the other side of the moon. He also con siders the Vanguard satellite program as a 'borderline" case, pointing out that it lacks official sanction as a "mili tary project."

Newbury said his own original idea for organization of the research, devel opment and engineering activity was that there should be an Assistant Secretary for Research and that all the development work belonged in his original bailiwick of Applications Engineering.

He indicated that his new office will include a number of divisions to cover such fields as atomic energy, general sci ence, ordnance, electronics and aero nautics.

The major job, as he sees it, is to review all major research and develop ment projects, exclusive of ballistic mis sile developments, and recommend ap proval of those which hold satisfactory promise.

Bigger Budget

Newbury deemed that his appoint ment was the cause of great concern among scientists on that it constitutes a victory of engineers over scientists. He said he had consulted with the Scien tific Advisory Board and came away with the impression that these men feel the prime need is for a bigger re search budget and that the Defense De partment should shoulder more of the burden.

Both Newbury and Secretary Wilson, however, feel that pure research should be the concern of such agencies as the National Science Foundation and Bu reau of Standards.

The Defense Department they say, should not invest in work that does not hold some potential value for the military services.

Newbury's views also were made clear last Monday in a speech by S. S. Pod nos, director of his Office of Ordnance and Transport Equipment. Podnos also served in this capacity in the old Office of Applications Engineering.

Research 'True Pursuit'

Podnos said research suffered under the two-office setup because the re search experts spent too much of their time on engineering development. He said that since 1953 both offices were concentrating on engineering and that research had been neglected as a con sequence.

The Newbury aide said research is more difficult than engineering and de mands more valuable talent. And he added, when a research scientist is given both an idea and a thing to work upon, he invariably emphasizes the thing and research suffers.

This detrimental practice must be stopped so that the scientist can con centrate upon the research that is his true pursuit. He also said:

"We in the Office of the Assistant Secretary for Research and Engineer ing are dedicated to the overriding im portance of both basic and applied re search as a means for maintaining and enhancing our position of technological superiority. The consolidation was made to increase, and not to diminish, emphasis on research.

Scientists' Concern

Actually, the scientific community is not expected to find fault with these precepts. From the start, its great concern has been with Newbury, his background as a former vice president of the Westinghouse Electric Co. and some of the policies he has promul gated in the Pentagon.

Both Newbury and Podnos made a strong point of their program to achieve a more realistic breakdown of how the taxpayer's money is spent in the re search field.

Because of the various overlapping activities and a "fuzziness" that hides the line between research, development and production, they maintain it has not been possible to get an honest figure on expenditures.

Podnos said the new Research and Engineering Office will find out how much of the appropriation really goes into research. And one of the pur poses of this effort, he declared, is to make sure there are sufficient funds.

USAF Reliability Emphasis Grows

Santa Barbara, Calif.—Emphasis which reliability factors may be given in future Air Force contracts was under scored at the 27th Air Force Industry Conference held here.

Among the things this emphasis might mean are:
- Cradle to-grave responsibility for re liability of a product.
- Exhaustive testing to failure of de velopmental models.
- Exhaustive testing of initial produc tion models and healthy samplings thereafter.
- Accurate determination of "mean time to failure" and perhaps a guarantee of this lifetime for parts, components and systems.

Addressing the conference, Brig. Gen. Joseph D. Caldara, director of USAF flight safety research, told the confer ence that absolute reliability is impera tive in missiles and high performance aircraft because of the dangers and money involved.

"When the American people invest many millions of dollars in a single vehicle or missile," he said, "we must be absolutely certain that it will per form without fail, the mission for which it has been designed.

"We cannot afford to have a multi million dollar missile fail because of a faulty 50 cent part obtained on a low bid contract.

"Aside from costs, these things must not fail or go astray if they are carrying atomic warheads. They must go to the target and only to the target. Failures cannot be tolerated at the prices these vehicles and missiles cost and the havoc they can cause."

Douglas Proposes Fleet Supply Aircraft

Washington—A four-engine turbo prop utility assault transport for aerial resupply of carrier task forces has been proposed to the Navy by Douglas Air craft Co.

In design and performance, the air craft is strikingly similar to the com pany's proposed DC-3 replacement, the 1940 transport (AW Mar. 25, p. 38).

Its purpose is similar to the two engine C-123 which Fairchild Aircraft Division has proposed as an assault air craft capable of operating from the decks of Essex class carriers (AW Jan. 21, p. 50).

The Douglas aircraft has been under study for several years and is now in advance design stage. It bears the com pany designation 1906A. As in the case of the 1940 transport, work on the model has thus far been financed en tirely by Douglas.

The company proposes the Lycoming T55 turboprop engine as powerplants for the 1906A. Fairchild's Navy C-123 would be powered by two Pratt & Whitney R-2800 reciprocating engines augmented by jet thrust from a Fair child J44 turbojet unit installed in each nacelle.

Carrier Operations

The 1906A will be equipped with arresting and catapult hooks for opera tion from aircraft carriers. Unlike the Fairchild proposal, Douglas is not offer ing folding wings and tail for on-deck parking of aircraft.

The company has informed the Navy that, should the aircraft become dam aged aboard the carrier, prompt fly away is possible since the 1906A can be flown from the carrier deck with one engine inoperative or catapulted with any two engines inoperative.

Douglas says 12 to 15 of the 1906As could be arranged on the flight deck of canted-deck carriers and still allow flight operations. The aircraft, the company says, can be flown from a ship with gear retracted in the event of landing gear damage. In the event of a damaged wing tip, the aircraft can be flown with both wingtips removed. The 1906A can be towed either backward or for ward using normal deck handling equip ment.

The 1906A is also designed to serve as a Marine assault aircraft.

Like the C-123, the Douglas trans port will have a 1,500 mile range, en abling it to service a task force at sea anywhere in the Northern Hemisphere from a large number of land bases. Within that range, the 1906A is de signed to takeoff with a gross weight of 65,500 lb. over a takeoff distance of 1,000 ft. at zero wind and cruise at 243 kt. with a 15,000 lb. payload.

Landing weight for an arrested car rier landing with a 25 kt. headwind is 51,980 lb. at an engaging speed of 39 kt. Carrier takeoff weight with zero payload is 48,420 lb. with a catapult takeoff distance of 225 ft.

Specifications

Wingspan of the high-wing Douglas assault plane is 102.5 ft. Length is 88.2 ft.; height of the tail, 36.8 ft. Wingspan and height are approximately the same as that of the 1940, although the commercial plane is four ft. shorter in length.

Upsweep of the fuselage base is slightly sharper on the 1906A, the ver tical tail on both aircraft is swept 30 degrees. The 1906A has a wing area of 1,300 ft. Lateral control is accom plished by spoilers, a feature not adopted on the 1940. The horizontal stabilizer is moveable for trim.

Douglas has avoided most of the complicated high-lift techniques in order to maintain simplicity and econo my of operation and maintenance. The short takeoff characteristic is pro vided by high-lift flaps, moderate wing loading—50.4 lb. per sq. ft. for carrier on-board takeoff weight—and high thrust-to-weight ratio turboprop en gines.

Both the 1940 and 1906A use 40% chord, double slotted full-span, trailing edge flaps and 15% chord leading edge flaps. Douglas is planning a series of wind tunnel tests to further develop the aircraft's lift system.

The fuselage is designed to serve as a cargo carrier but will handle a maxi mum of 58 troops by installing troop benches. It also can carry 54 litters plus a crew of four.

Cargo Compartment

Volume of the cargo compartment is 2,620 cu. ft. with a floor area of 177 sq. ft. The cabin is 146 in. wide, 98 in. high.

The cargo floor is designed to hold a uniform loading of 300 lb. per sq. ft. The cockpit will be pressurized to 8,000 ft. when the aircraft is operating at an altitude of 25,000 ft. The cargo com partment is not pressurized.

Douglas has made a firm decision on the T55 as the powerplant for the 1906A but has not yet dropped the Rolls-Royce 510 Dart turboprop from consideration for the 1940. The T55 develops 1,651 shp. on takeoff and weighs 665 lb.

Here is what Douglas wants in the powerplant for the 1906A:
- Full-feathering, reversible pitch pro pellers which the company will order from Hamilton Standard, Aero Prod ucts or Curtiss-Wright.
- Easy engine accessibility through large hinged doors on the lower side of each semi-monocoque nacelle.
- Self-sealing and integral wing fuel tanks.
- Electrical starters for each engine.

The 1906A's three wheel landing gear provides a level cargo floor 50 in. above the ground. The landing gear structure is designed to meet specification carrier landing loads for this class of aircraft. The nose wheel is steerable 60 degrees either side of center.

Landing Gear Skis

Skis are fitting to all three wheels for operations on unprepared surfaces when the aircraft is used on Marine assault missions. Since the wheels drop slightly below the ski surface, the air craft can taxi directly from an unpre pared area to a hard surface without any landing gear adjustment.

Electric heating units serve as de icers on air intake scoops, propeller blades and spinners.

Anti-icing on the outer wings and horizontal stabilizer is obtained by heat ing ram air with combustion chambers, one in each outer wing nose section and one in the aft fuselage since engine compressor bleed air is not available.

Wing heaters are installed in the leading edge flaps. A heater in the aft fuselage furnishes heat to the cargo compartment and serves as an anti-icer for the stabilizer. Windshields are anti-iced by electrical conductive coatings.

The loading cargo door is designed to expedite cargo handling and permit air drop operations. For cargo loading, the door drops to serve as a loading ramp and for air drop operations the door may be raised internally without effecting aerodynamic lines. Air drop speeds can be as low as 70 kt.

The arresting hook for aircraft deck landings is attached to the cargo door and retracts flush to the door. Arrest ing wire run-out is based on 220-ft. re quirements, although Douglas feels that wire run-outs of 50 and 100 ft. are feasible in view of the low landing speed of the aircraft. Maximum land ing attitude is a nine degree angle at full stall.

Maximum ferry range of the 1906A is 3,000 nautical miles without pay load. A 7,600 lb. payload can be car ried for a typical ferry range of 2,400 nautical miles.

On carrier-on-board missions, the air craft—transporting 16,000 lb. maximum payload at 20,000 ft. altitude—can de liver over 100 tons of cargo through 12

flights per day over a 1,400 nautical mi range. With 19 flights a day over the same range, tonnage can be increased to 150 tons.

Operating Cost

Direct operating costs in cents per ton mile vary from 14 cents on a 500 nautical mi flight to slightly over 13 cents for a 1,400 nautical mi flight at which point, direct operating costs rise sharply to 30 cents for ranges of up to 2,500 nautical mi.

Performance of the 1906A for Marine assault missions with a 16,000 lb payload at a gross weight of 58,940 lb requires a takeoff distance of 872 ft with zero wind. Cruise speed is 264 kt., block-to-block speed 243 kt., and radius of flight, 200 nautical miles. These figures are based on takeoff from a hard surface runway.

In operations on unprepared fields, landing weight is 55,850 lb. and calls for a 475 ft. ground roll with zero wind, while gross takeoff weight is 39,850 lb. over a takeoff distance of 203 ft.

British Strike Causes Airline Delivery Delay

London—Delay in deliveries of Bristol Britannias and de Havilland Comets to U.S. airlines is threatened by a strike which has crippled much of Britain's aircraft industry.

Strike is part of a general walkout in the nation's engineering industries in support of a 10% wage demand.

Britannia assembly lines were idle at aircraft and engine plants of Bristol Aeroplane Co., where 15,000 workers left their jobs. De Havilland has been forced to shut down its Chester plant which has been at work on Comet 4 and 4A jet transports for Capital Airlines.

Nearly 10,000 employes walked out of Short Brothers and Harland plants in Northern Ireland, halting work on Britannias for Northeast Airlines, British Overseas Airways Corp. and the Royal Air Force. First Northeast Britannia was scheduled to make its initial flight before the end of this month.

Military production also has been hit. A.V. Roe said a long walkout will seriously delay production of Vulcan bombers and Shackletons. Elsewhere in the Hawker Siddeley group, 74% of the labor force at Hamble has walked out on production of Javelin fighters.

Rolls-Royce reports 11,000 workers on strike affecting work on Avon jet engines. Other companies hit by the walkout include Folland and Napier.

T-37A Engine Fixed

All Cessna T-37A two-jet primary trainers are expected to be flying again in two to four weeks as a result of a modification on the airplane's J69-T-9 engine devised by Continental Aviation & Engineering Corp. USAF grounded the trainers in March because of stringer cracking problems (AW Mar. 18, p. 28).

Aviation Week learned a modification in welding technique in manufacturing J69-T-9 shafts was involved. Exclusive Aviation Week flight evaluation of T-37A starts on p. 48.

Gen. Nathan F. Twining

James H. Douglas

Gen. Thomas D. White

Defense Changes Promote White, Douglas

Washington—Nomination of Gen. Nathan F. Twining as the first Air Force chairman of the Joint Chiefs of Staff, a move first predicted by AVIATION WEEK last Jan. 28 (p. 25), was formally announced by President Eisenhower last week.

At the same time, the White House asked the Senate to confirm USAF Secretary Donald A. Quarles as Deputy Secretary of Defense to replace the retiring Reuben Robertson, Jr.

Gen. Twining, Air Force chief of staff since June 30, 1953, will succeed Adm. Arthur W. Radford. Radford's second two-year term expires on Aug. 15.

Quarles, scheduled to take over from Robertson on April 25, will be succeeded as USAF Secretary by James H. Douglas, now Under Secretary of the Air Force. Douglas' promotion was predicted by AVIATION WEEK last Sept. 10 (p. 25).

Gen. Thomas D. White, Air Force Vice Chief of Staff, will step up to take over Gen. Twining's post as USAF chief of staff.

In the shuffle of top Defense Department posts, Eisenhower also asked the Senate to approve Adm. Arleigh A. Burke to a second two-year term as chief of naval operations.

The resignation of Robertson, who announced he would spend only two years in government when he came to Washington in 1955, was accepted by the White House early last week. He will assume his former position as president of the Champion Paper and Fiber Co.

Gen. Twining, who will be 60 in October, will become the third chairman of the Joint Chiefs since the post was created by the National Security Act in 1947. His four-year term as USAF Chief of Staff would have expired on June 30.

Secretary Quarles first came to Washington as Assistant Secretary of Defense in September, 1953. He succeeded the late Harold E. Talbott as Air Force Secretary when the latter resigned under pressure in the summer of 1955.

Martin, Ryan Sales Rise, Profits Fall

Increased sales, substantial backlogs but lower profits were reported for 1956 last week by Glenn L. Martin and Ryan Aeronautical Co.

Another firm, Republic Aviation Corp., which went through a 16-week strike early in the year, reported a decline in both sales and earnings.

In its annual report for calendar 1956, Martin reported record peacetime sales of $358,961,622 and a backlog of $810 million, more than half of it in guided missile contracts.

The sales represented a 32% increase over 1955 but, despite this, net income dropped to $10,839,656 from the 1955 figure of $13,285,297.

Martin President George M. Bunker attributed the decline to these two factors:

- **Inclusion in the 1955** figure of $3,485,555 in non-recurring warranty items and royalties from prior years.
- **Fact that more** than half of the 1956 sales were from cost-plus-fixed-fee developmental and pre-production contracts that are traditionally less profitable than production contracts.

Ryon Report

Ryan, reporting on the fiscal year ending last Oct. 31, listed a 13% gain in sales—$46,998,925 as compared with $41,527,770 for Fiscal 1955. Backlog of business, as of Jan. 31, stood at $92 million as compared with $37 million at the close of the 1955 fiscal year.

Net profits, however, declined from 1955's $1,550,590—$4.07 per share—to $1,256,769—$3.36 per share. The company attributed the lower profits to the high "make ready" costs for early phase work "on the new major items on contract now entering production."

"Make-ready" costs included preparation for the production of aft fuselage sections for USAF's Boeing KC-135 jet tanker-transport and the 707 commercial version, power packages for Douglas' DC-8 commercial jet airliner and advanced versions of the Ryan Firebee Q-2 and KDA jet drone missiles on prime contracts with the Air Force and Navy.

Book value per share of Ryan's 374,000 net shares outstanding at the fiscal year's end was $29.27, a gain of $2.75 over Fiscal 1955.

Martin reported net income per share of 2,904,041 shares outstanding at the end of the calendar year at $3.73 as compared with $4.68 at the close of 1955.

Republic

Republic Aviation's net profits for 1956 stood at $7,367,435 on sales of $346,214,310 as compared with 1955 earnings of $14,731,134 on sales of $547,387,242.

Sales are expected to continue to decline somewhat during 1957 because of the completion of F-84F deliveries to the Air Force. Volume production of the supersonic F-105 fighter bomber won't get under way until 1958. Production of the reconnaissance version of the F-84F was completed last year.

Republic's backlog as of Dec. 31 was reported at $226 million. Additional orders being negotiated at the time had a value of $334 million. Per share earnings on 1,472,013 common shares during the year were $5 as compared with $10.01 in 1955.

Glenn L. Martin's total expenditures for plant, property and equipment in 1956 totaled $16,856,191, with a major share of the total going for the company's new plant at Denver where the Titan intercontinental ballistic missile will be produced for USAF.

Vertol, Kaman

In the helicopter field, Vertol Aircraft Corp. reported record sales and earnings for 1956, while both sales and earnings for Kaman Aircraft Corp. declined during the year.

Vertol recorded net earnings of $3,437,563 on sales of $90,025,697 for 1956, a 121% increase in earnings and a 56% gain in sales over the previous year.

Backlog as of Dec. 31 was $117 million as compared with $125 million at the end of 1955.

Military orders for the H-21 are almost completed, however, and Vertol President Don R. Berlin admits that "the declining rate of deliveries now on the books for 1958 and the long lead times required for helicopter production make it probable that employment this year will be reduced."

Vertol hopes to plug the gap through the certification of the H-21 for civilian operation and by improving the capabilities of the H-21 itself through the installation of two turbine engines sometime this spring.

Kaman said the drop was due to a stretchout in delivery schedules of Navy's HOK-1 helicopter. The stretchout, plus a new production contract, increased HOK-1 production by a year and a half, to January, 1959.

Kaman sales for the year declined to $12,380,865 from 1955's $14,503,869. Net earnings for the year were $400,222 as compared with $428,815 in 1955.

Other companies reporting included:

- **Burroughs Corp.**, revenues of $272,879,246, for a gain of $52,476,794 over 1955, and net income of $14,197,021, an increase of $2,365,517.
- **Air Reduction Co.**, record sales and earnings. Sales in 1956 totaled $169,818,703, an increase of approximately 14% over 1955's $149,231,826. Net earnings for the year were reported at $15,731,579 as compared with $11,569,290 in 1955.

Minneapolis-Honeywell Drops Boston Transfer

Minneapolis-Honeywell has dropped plans to transfer its transistor manufacturing and engineering operation from Minneapolis to Boston, based on new estimates of the cost of such a move and of new facilities.

The action had given rise to rumors that Minneapolis-Honeywell was retiring from the transistor field, but company says it now plans expansion of its Minneapolis facilities. Some transistor engineering and research activities will remain in Boston.

Australia to Order C-130, F-104

Melbourne—Australia will pattern the Royal Australian Air Force on the U.S. Air Force and in the future will order only U.S. made or U.S. type equipment, starting with the Lockheed C-130 and F-104.

Ties will not be entirely broken with RAF, but emphasis will be on cooperation with U.S. Air Force and the adoption of U.S. policies and methods.

Initial order for 12 C-130 Hercules transport aircraft may later be doubled, but if USAF decides that other planes, developed in the meantime, are better, RAAF will place its orders for additional planes with the manufacturer recommended by U.S. Air Force.

Australian stores of spare parts and maintenance facilities for the Hercules aircraft will be in excess of domestic demand. The idea is to have emergency stores and facilities for USAF.

RAAF expects a relatively early delivery of a small number of F-104 fighters made in the States and hopes to obtain a license for the manufacture of both the General Electric J79 engines and the airframes.

Australian-made aircraft might be exported to New Zealand or SEATO nations, though Lockheed has yet to agree. Lockheed has been attempting to interest the New Zealand air force in the two airplanes, and also is trying

Sea Venoms Grounded

Melbourne—Royal Australian Navy again has grounded its entire fleet of de Havilland Sea Venom aircraft. Grounding order applies to planes aboard carrier Melbourne and to those at the Nowra base in New South Wales.

Airframe problems are blamed for the grounding. Australian Navy has had some fatal accidents with its Sea Venoms. Extent of the currently examined airframe problems is not yet fully known but information from the Royal Navy in England indicates expensive rebuilding of parts of airframe may be necessary.

to sell the Electra Turboprop transport to Tasman Empire Airways.

In spite of strong British pressure there will be no orders placed for the P 1 fighter nor for any other British fighter.

The policy to buy only U.S. type aircraft will be applied to equipment other than aircraft and spares although British manufacturers are willing and anxious to supply some equipment suitable for operation with U.S. made or U.S. type equipment. Such equipment, as flight simulators, may be bought in the United Kingdom.

Initial requirements of the RAAF for the F-104 would be between 35 and 40 units. In about two years, RAAF, assisted by U.S. advice can estimate further requirements in the light of information available on the obsolescence factor of F-104s, importance of missiles vs. fighters and probable availability of new fighter types.

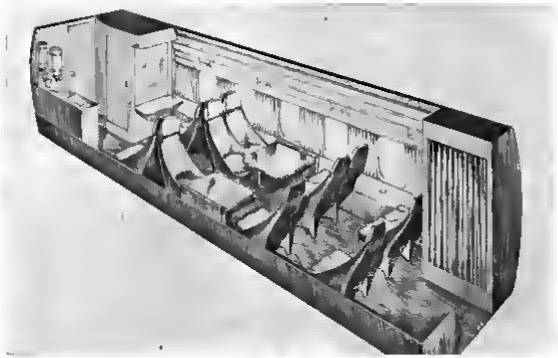
No purchases of bombers are envisioned, but crews may undergo training, including training in the United States, to be able to fly modern bombers in time of emergency.

Such a policy regarding bombers will economize on foreign exchange. The bomber policy reflects a new line of thought among RAAF officers and Australian government policy makers. They would like to put emphasis on very highly trained flying crews, on thoroughly experienced ground staff and on maintenance and repair bases second to none. In case of emergency they are hopeful of obtaining front-line U.S. aircraft and equipment. It appears that some assurances to this effect were obtained during the last meeting of SEATO in Canberra.

Flying training in the RAAF will for the time being be conducted on existing de Havilland Vampire trainers. Next series to be ordered will probably be a U.S. jet trainer to be made under license in Australia.

As for missiles, the RAAF is looking forward to receiving air-to-air and air-to-ground missiles of U.S. design.

VARIED LOADING possible includes two Jeeps, which can be driven up integral ramp (top), heavy cargo, moved directly from truckbed level, using plane's monorail, winch and mobile pallets (center) and high density troop carrier interior, for 28 fully armed soldiers on wall-type side-by side seats. Civil high-density passenger model can seat 27 passengers. Another interior layout allows 22 litters to be installed.



PLUSH TRANSPORT for businessmen or military staff officers has 12 comfortable chairs.

DHC-4 CARIBOU utility transport is sketched bearing U. S. Army markings to show how it will look when that service takes delivery in 1959. Army is getting five for evaluation. Swept up rear fuselage has loading ramp for fast stowage of up to 7,300 lb. of cargo.

DHC-4 Combines DC-3 Load With STOL

Wide range of military and civilian missions at low operating cost will be possible with de Havilland Canada's new twin-engine DHC-4 Caribou utility transport, first detailed specifications show.

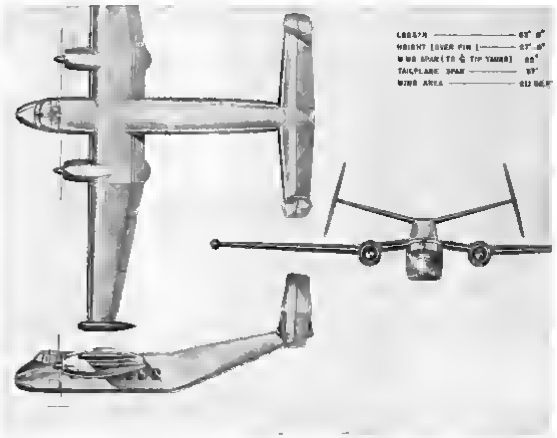
According to latest official data, the Caribou will be basically in the DC-3 load carrying category but will have takeoff and landing performance from rough airstrips equal to or exceeding the single-engine Beaver and Otter.

Direct operating costs are estimated by the manufacturer as $99.37 per flight hour and direct operating costs per ton/statute mile as 18.7 cents.

U.S. Army has ordered five Caribous for evaluation at a cost of $2.5 million (AW Jan. 28, p. 34). Deliveries are scheduled to begin early in 1959, with the initial prototype making its first flight by midsummer 1958.

Although initial production Caribous will be powered by 1,450-hp. Pratt & Whitney R2000 piston engines, de Havilland-Canada notes that future installation of turboprops "is a practical consideration." Wright R1820 is available as an alternate piston engine choice.

Basically an all weather utility trans-



WIDE-SPAN TAIL, with twin rudders cranked wing and upswept fuselage are noteworthy design characteristics of new Caribou. Boxy fuselage layout is planned for maximum use of interior for variety of loading including passengers, bulky cargo and vehicles. Besides U. S. Army orders, further orders are expected for Canadian Army.

DHC-4 Caribou Specifications

SPECIFICATIONS

Wingspan (to Center Line of Tiptanks)	95 ft
Wing Area	912 sq ft
Aspect Ratio	10
Horizontal Tail Span	37 ft
Horizontal Tail Area	250 sq ft
Vertical Tail Total Area	180 sq ft
Maximum Height	27 ft 8 in
Clear Height Under Tail	10 ft
Cabin Volume	1,052 cu ft.

WEIGHTS

Empty Weight	14,500 lb.
Radio	200 lb.
Fuel and Oil for 500 mi. (With Reserves)	2,575 lb
Two Crew Members	340 lb
Payload for 500 mi. (Stripped Freighter)	6,385 lb
Design Gross Weight	24,000 lb
Deicing Equipment	315 lb
Passenger Furnishings	up to 1,500 lb

PERFORMANCE[1]

Powerplants: 2 P&W R2000 D5 at 1,450 bhp

Takeoff Rating at 2 700 rpm at Sea Level. Max. Continuous Rating, 1 200 bhp at 2,500 rpm. Normal Rated Power, 1 200 bhp, High Impeller Ratio 1 100 bhp

	Zero Wind	10-mph Headwind
Takeoff Ground Run	450 ft.	330 ft.
Takeoff Run to Clear 50-ft	800 ft.	650 ft.
Landing Run (Dry Concrete)	300 ft.	230 ft.
Landing Distance Over 50 ft	700 ft.	550 ft
Climb Gradient After Takeoff	18%	

En Route Rate of Climb (Normal Rated Power)	1,580 fpm
Rate of Climb, One Engine Out	420 fpm
Rate of Climb at 5,000 ft., Two Engines	1,580 fpm.
Rate of Climb at 5,000 ft., One Engine Out	380 fpm.
Service Ceiling, Two Engines	26 000 ft
Service Ceiling, One Engine Out	13,000 ft
Cruise Speed, TAS, at 750 bhp, at 7,500 ft	185 mph
Stalling Speed, Flaps at Landing Position	59 mph.

PAYLOADS, (FREIGHTER)[2]

200 Statute Mi	7 320 lb
400 Statute Mi	6 700 lb
600 Statute Mi	6,000 lb

[1] Performance is at 24,000 lb. gross weight under International Standard Atmosphere conditions unless otherwise stated.

[2] Payload-range data include these fuel allowances: climb from sea level to cruise altitude; descent from cruise altitude to sea level, final circuit and landing, reserve fuel for 45 min. flight at cruise power.

port, the Caribou is designed to handle these roles:

- **Front-line** Army vehicle capable of carrying 28 combat troops in bench type seats. Civilian transport will carry 27 passengers. Ambulance version will carry 22 litters.
- **Military or commercial** cargo plane with payloads varying from 6 000 lb over 200-mi. range to 7,320 lb for 600 mi. Ultimate range is 1 200 mi. with full standard tanks.
- **Executive or military** staff transport carrying 12 passengers in comfortable seats with headrests.

Simple, conventional structure will be used capable of taking rough treatment with a minimum of field maintenance. Unobstructed cabin area will be accessible through large rear loading doors under the tail. Cabin floor dimensions will be 73½ in. by 73 ft., cabin height 73 in. and width at elbow level 83 in. Floor height from the ground will be 42 in. to facilitate direct loading from trucks.

Facilities will be included for mounting a monorail crane, winch and mobile pallet to speed loading. Loading ramp may be positioned horizontally for direct loading from truck bed height, or may be lowered to the ground, permitting entrance of small vehicles. Caribou will be capable of taking two Jeeps.

Another prime characteristic of the Caribou will be its short field performance, aided by its full-span double slotted flaps with outer trailing portions working independently as ailerons. Landings and takeoffs will be possible from unprepared strips 800 ft. long. De Havilland estimates actual takeoff run as 450 ft. in zero wind and states that takeoff distance with a 10-mph headwind should not be over 330 ft.

Flight performance includes cruise speed of approximately 185 mph. at 51% takeoff power. Touchdown landing speed will be less than 60 mph. Rate of climb at sea level with two engines is estimated at 1,580 fpm., with one engine out, climb will be 420 fpm. Service ceiling is planned for 26 000 ft. Single-engine ceiling of 13,000 ft. is calculated by the builder.

After the Caribou completes civil airworthiness trials, it will be turned over to the Canadian Army for further tests.

Business Amphibian To Use Ducted Fan

Los Angeles—Twin-jet, 8-place, 450-mph. utility amphibian designed projected by Aircraft Marine Engineering Co., Sepulveda, Calif., is for an advanced Turbomeca ducted fan engine.

The amphibian presently is being developed around Turbomeca's Aspin II turbofan (Continental Aviation & Engineering Corp.'s Model 420), but requirements for increased range and speed have prompted AMEC officials to investigate new powerplant possibilities. Conferences were held recently with Turbomeca's director general, Joseph Szydlowski, who was accompanied by Armand Villatte, chief engineer of French Air Ministry for gas turbines; William Strang, Turbomeca's chief engineer, and Charles C. Bisenkell, West Coast executive engineer for Continental Aviation & Engineering Corp., Turbomeca's American licensee.

Mockup of the amphibian is being built in a temporary plant in Van Nuys, Calif. Prototype is expected to fly in 1958, company officials say. The plane is a high midwing configuration, will gross about 9,000 lb., which will include about 4 100 lb. structural weight. Span will be 46 ft., length 37 ft. Wings will not be equipped with floats but landing gear will double in service as sponsons.

The craft also will have STOL capability. Its boundary layer control system will feature super-circulation to accelerate the flow over flap and aileron, and distributed area suction over upper surface of the wing.

F-89 Radar Not Locked on DC-7 In Collision, CAB Hearing Reveals

By Richard Sweeney

Los Angeles—Northrop F-89J Scorpion which collided in midair with a DC 7B over the rim of the San Fernando Valley Jan. 31, was in a 30 deg. bank to the left at the moment of impact. The F-89's radar was in navigation (beacon) mode at the time of collision, precluding any possibility the interceptor was mistakenly locked onto the transport or that a radar presentation could have warned of the impending crash.

This was brought out at Civil Aeronautics Board hearings here into the crash which took eight lives, including three school children who were struck when the DC 7B wreckage fell into the athletic yard of the Paconma Junior High School. Other testimony:

• **Examination of** wreckage by CAB structures group investigators showed the DC 7B suffered structural failures in aft fuselage and empennage areas just prior to wreckage striking the ground. Airload failures were induced, the structures investigation report stated, when the DC 7 pilots made a last second effort to hold their almost uncontrollable aircraft in the air an other second or two, long enough to clear the school.

• **Scorpion radome nose** struck the DC 7B wing leading edge between stations 530 and 613, shearing off 8½ ft. section of transport wing which was recovered by structures investigators in good enough condition to yield valid information on the impact. The Scorpion's nose was demolished back to fuselage station 125, crushing radar and the forward fuselage fuel tank. Top and bottom sections in this area were recovered and, combined with the DC 7B wing evidence, showed the Scorpion angle of bank at impact.

• **Impact area scrutiny** showed longitudinal axis centerlines of the two airplanes were almost parallel. DC-7 airfoil tears indicates the F-89 flight path was closer inboard at the transport wing trailing edge than at the leading edge, convergence angle averaging 3 deg.

• **Close approximation** of the collision location over the ground was obtained from a Los Angeles city surveyor, Ford Taplin, who took sights with his already aligned transit. Increasing value of Taplin's observations, although they were made the day after the crash, was the fact that the witness served as an Air Force basic and advanced instructor during World War II, has 2,500 hr. flight time, holds a commercial pilot's certificate with instrument rating. His sights placed the crash over a hilly area which is not heavily populated. Tracks of the aircraft were estimated at generally west for the DC-7, east for the F-89. Witness accounts of the crash indicated that after the impact:

• **DC 7B,** on a track of 260 deg., appeared to stay in its path a few seconds, then enter a steep dive. The plane turned about its longitudinal axis giving the appearance of a spin part of the way down, straightened out and hesitated two times as if the pilots were attempting to level out. Just before ground impact, the plane appeared to blow up or disintegrate, this apparently being the point where the air load structural failures related by the structures group investigation report occurred. There was no fire on the DC-7 during its fall.

• **F-89** enveloped in fire, described a very short curve in its fall after momentum of its 380 kt. TAS at impact dissipated. Saw one person eject from the jet very shortly after the impact. The F-89 followed a course of 150 deg. during its fall.

Further substantiating the theory of the last ditch DC-7 pilot effort to clear the school area, the CAB powerplant investigating group noted in its report that all four engines were torn from their nacelles before ground impact, the failures all from downward bending.

Testimony by Arnold Heimerdinger, Douglas Santa Monica flight operations manager, was to the effect that the flight was the first for the airplane, which was built for Continental Air Lines.

Report by the CAB flight operations group showed the airliner had taken off from Santa Monica, proceeded over the ocean to Catalina Island where a "routine" report was sent to Douglas ground control. The plane then climbed to 25,000 ft. and again checked with Douglas at Ontario, 50 air miles from the Santa Monica plant. Report was again "routine." Next transmission was the last, telling of the collision.

Radio reports by the F-89 to Northrop facility at Palmdale, indicate the required radar runs were being carried out when the crash occurred, the flight operations report said.

On the witness stand, Northrop Test Pilot James Bugbee, pilot of the target F-89 taking part in the radar check, said his last message from Roland Owen, who was flying the interceptor involved in the crash, was an instruction to "start your 90 now, Jim." The radar check flight pattern consisted of a series of scissors maneuvers, with 90 deg. turns by both aircraft between passes to bring the planes back together again on the proper intercept heading. Bugbee said that it was normal for Owen to have been in a turn himself after giving the target ship orders to turn, and it also had been Owen's custom to tell the target ship pilot after the turn, "steady on." Bugbee said he never got this word from Owen, although he was not sure of the lost airplane's exact position or attitude at the time of the crash.

In addition, Bugbee said, he was not sure whether Owen was flying his plane with autopilot or manually, either being possible. The F-89 fire control system is such that the pilot must fly the aircraft either manually or with autopilot to keep the target plane in the proper scope position. The system does not incorporate a data link which changes radar signals into flight control movements through the autopilot for a full "hands off" intercept by the airplane.

F-89 Nuclear Capability

Northrop F-89 Scorpion radar and fire control system gives it the capability to handle the Douglas Ding Dong nuclear warhead air-to-air missile as an intercept weapon, testimony indicated at a CAB hearing in Los Angeles on an F-89 collision with a DC-7.

Radar records from the aircraft in the crash showed that special weapons test runs had been made prior to the crash. The radar observer of the F-89, who survived the crash, also mentioned the special weapons configuration.

News Digest

General Electric will supply T58 turboshaft engines for Vertol's H-21 helicopter program under $2 million USAF contract. Two T58s will be tested in H-21 as replacements for single piston engine.

Northrop Aircraft orders for components for T-38 supersonic trainer passed 300 mark. Major order so far is to Cleveland Pneumatic Tool Co. for landing gear.

First Lacrosse Missile came off production line at Glenn L. Martin Co.'s Orlando, Fla., plant.

General Electric will design and develop self-contained auxiliary power units for supplying electric and hydraulic power for North American's X-15.

Local Lines Split, Form New Association

Eastern, western carriers divide on basic policy; association of local and territorial airlines formed.

By L. L. Doty

Washington—The deep breach between eastern and western local carriers now appears irreconcilable.

The sharp split, which had been developing over the last two years, began coming to a head on Feb. 11 when six western carriers resigned from the Conference of Local Airlines in a joint letter sent to Conference Chairman John Floberg (AW Feb. 18, p. 25). The resignations left the conference with seven members.

The six dissident members have now formed a new group known as the Assn. of Local and Territorial Airlines in a blunt rebuttal to attempts to reconcile differences between the two groups.

Although the action was taken as a result of growing resentment against the conference's methods of solving many local airline problems, differences between the two groups on broader issues of basic operating policy have created an even wider spread division.

Why the Split

Some of the issues causing the separation are:

• **Guaranteed Loan Bill.** Western carriers would like to see this bill pushed through Congress so that their re-equipment programs can be launched as soon as possible. The six airlines sent a letter to the Civil Aeronautics Board endorsing a CAB suggestion for government guaranteed loans at the same time they resigned from the conference. The conference has not yet taken a public stand on the proposed bill.

• **Capital Gains Bill.** Some western airlines see little value in this bill as a means of building funds for the purchase of new equipment. They point out that capital gains from the sale of DC-3 equipment will make only a minor contribution toward the purchase of more modern aircraft. Most eastern carriers want to see this bill precede the Guaranteed Loan Bill on the grounds that Congress will be more receptive to the Capital Gains Bill and "first things should come first."

• **Rate of return.** Most western carriers are supporting a revision of the rate of return formula but prefer to pump for better route structure and more modern equipment as a means of attaining self support. As one western airline official said, "Liberalized subsidy will never provide us with long-term protection." Many eastern carriers see no escape from subsidy for years to come.

Dissenters

Dissident airlines include West Coast Airlines, Bonanza Air Lines, Central Airlines, Ozark Air Lines, Lake Central Airlines and Frontier Airlines. Southwest Airlines joined the group in signing the letter endorsing Government Guaranteed Loans but retained its membership in the conference.

Chairman of the new association is Nick Bez, president of West Coast Airlines. Joseph P. Adams, former member of the Civil Aeronautics Board, has been retained as counsel for the group and will act as executive director until a full time director is selected.

The association also hopes to attract territorial airlines as members. Trans-Pacific Airlines has joined the group as an allied member, and Hawaiian Airlines will propose membership at its next board of directors meeting. Alaskan carriers also have expressed an interest in the new organization.

The six carriers have been unhappy for some time with the progress made by the conference and have charged it with failing to take any action on a number of matters such as the Guaranteed Loan Bill. The six also are unhappy over conference's alleged lack of "aggressiveness" in attacking local airline problems.

According to Keith Kahle, Central Airlines president, his company withdrew its membership because, "We weren't getting what we thought we should from the conference." He said that, on visits to Washington, he was "amazed" at how little federal officials know about local airline problems both at the CAB and in Congress.

Conference Aims

The Conference of Local Airlines was formed in 1953 under the direction of Chairman Donald W. Nyrop, now president of Northwest Airlines. Purpose of the organization was to represent the carriers on problems peculiar to local service operations and on matters that might not necessarily fall within areas covered by the Air Transport Assn.

Floberg was named to fill the position vacated by Nyrop in November of 1954. Legislation passed in 1955 granting the local carriers permanent certification is generally attributed to the work done by the conference.

Most carrier members have been anxious to establish a permanent headquarters with a regular staff to handle conference activities. Such a program was being developed but was dropped when the six airlines withdrew their membership. Floberg continues to conduct conference activities from his law offices here.

The new association will vest control in a board of directors headed by a chairman and vice chairman. The board will consist of six directors from the local service airlines, two from the Alaskan carriers and one from the Hawaiian airlines if and when the latter two groups decide to join. A full-time executive director will be hired by the nine-man board.

Dividing Line

Unanimity of opinion on the various issues involved does not always exist within either of the two groups, and the line of division between the two is not yet entirely clear. But this much is admitted by most members of the conference—the ultimate goal of all carriers is essentially the same. Only the method of approach toward reaching the goal differs, and this difference may weaken the effectiveness of the overall drive toward self-sufficiency.

For example, the western carriers may possibly bring their plea for government guaranteed loans direct to Congress without seeking CAB support. They contend that permanent certification for local service carriers was passed by Congress in 1955 without CAB's endorsement of the bill.

Eastern carriers, however, argue that permanent certification had the backing of constituents in virtually every congressional district but that this will not be the case on the Guaranteed Loan Bill. They emphasize that CAB backing will be essential to a program that is loosely presented to Congress by an industry split down the middle.

The six airlines have a deep-rooted feeling that the conference has been dominated by Mohawk Airlines, Piedmont and Allegheny Airlines. They further charge that these airlines either own or have ordered modern equipment and are not faced with an urgent need for guaranteed loans.

Allegheny operates a fleet of five Martin 202s in addition to DC-3s, Mohawk operates seven Convair 240s and Piedmont has ordered 12 Fairchild F-27 turboprop transports.

However, three of the six resigning airlines have also ordered the F-27; Bonanza two, West Coast four and Frontier four. Other airline planning to purchase the F-27 is Southwest with two on order.

Many of the stronger carriers are resisting the Guaranteed Loan Bill on grounds that it would place them deeper under governmental control. They fear such a situation would remove any traces of individual enterprise in future progress.

Midwest and southern airlines also have shown resentment over the alleged domination by the three relatively large carriers, but they have generally supported the conference's practices and policies.

For example, Trans-Texas President Earl McKaughan says there was no real decision for his company to make in the battle since he is generally satisfied with the work the conference has done and believes the "program is progressing fairly well and in an orderly fashion."

This conservative approach appears to be typical of the carriers remaining in the conference. Generally, they feel a strong need for a conference that will supplement the Air Transport Assn. by lending direction to a program designed to strengthen the carriers' positions.

Two associations, they say, can have only a damaging effect on this program.

Route Progress

All carriers are hopeful of obtaining more profitable routes through the lifting of restrictions on present routes. Conference members feel that considerable progress has been made in this direction through the "skip-stop" decisions and cite the award of non-stop rights between Syracuse and New York as an example. North Central is hopeful of getting Duluth-Chicago non-stop rights and is now awaiting the CAB examiner's decision which is due shortly.

Need for patience is emphasized by the conference members as a result of philosophy expounded by CAB bureau chief of air operations in the Seven States Area Investigation. The Bureau counsel said "each local service carrier should be given a free hand to develop 'its area'."

It was recommended that authorizations granted be "subject to the condition that after each point has been served on two round trips daily, it may be overflown on additional flights provided stops are made at two intermediate points on all flights between the local service carrier's terminal points which are served by the same trunk carrier."

Bonanza Airlines is claiming that strengthening of the route structure is "inseparably related" to the operation of more modern aircraft if self-sufficiency is to be realized.

Equipment Needs

The airline points out that local service carriers using the DC-3 must attain an average load factor of 98% in order to break-even. It contends that future progress toward self-sufficiency, even with some route improvement, is subject to "serious limitations" with DC-3 equipment.

To support its order for the F-27, the airline told the CAB that it would have a break-even need of $968,000 in 1959 with an all DC-3 operation over its existing routes. It added that, even if the F-27 did not stimulate any additional traffic, it would reduce the break-even need to $729,000." If traffic were stimulated by 15% by the F-27, the break-even need would be reduced to $488,000, the airline said.

The Guaranteed Loan Bill received strong support from the CAB late last year when James Durfee, CAB chairman, told Floberg that the "development of a program of equipment loans guaranteed by the federal government to assist the local service airlines in financing needed modern aircraft under appropriate circumstances" would be looked upon with favor by the Board.

It was this letter that prompted the endorsement by the six local airlines. The conference has taken no position on the issue.

Adams' Proposals

Floberg has declined to comment publicly on his stand concerning the issue. Joseph Adams told AVIATION WEEK that he had not met with the new association's board of directors to formulate a policy program since his appointment to the post.

He did say he would recommend to the group an improved rate structure as a means of aiding local service carriers. Adams also said he will ask the association to support the campaign by Rep. Dan Flood (D.-Pa.) to transfer more commercial military traffic from the Military Air Transport Service airlines as a means of increasing revenue passenger miles.

CAB hearings on the Rate of Return Bill have been heard and exhibits are due May 15. Capital gains hearings also have been held, and a CAB bureau counsel brief is due May 15. Industry briefs are due on June 16.

Senate Group Voices Opposition To Netherlands Bilateral Pact

By Ford Eastman

Washington—Dutch negotiators seeking new concessions before the signing of a U. S.-Netherlands air agreement found little support for their cause last week from the Senate Interstate and Foreign Commerce Committee.

Committee chairman Sen. Warren C. Magnuson (D.-Wash.) said his group does not even favor the signing of a bilateral air transportation agreement with the Netherlands. Instead, he said, the committee feels that the current policy governing commercial air operations between the two countries should be continued. At present, Pan American-World Airways operates between New York and Amsterdam under permission granted by the Dutch, and KLM, Royal Dutch Airlines, operates between Amsterdam and New York with U. S. permission.

Sen. Magnuson aired his views after a closed conference between the committee, State Department officials and members of the Civil Aeronautics Board.

Purpose of the meeting, the Senator said, was to have a complete and frank discussion on the U. S.-Dutch negotiations, negotiations with the United Kingdom and the signing of the recent U. S.-Mexican air bilateral agreement (AW Mar. 18, p. 45).

The current conference resulted from objections to the signing of the Dutch agreement filed by Stuart G. Tipton, president of the Air Transport Assn.

Tipton said a majority of U. S. air carriers feel that they have not had an adequate opportunity to be heard.

Tipton said the airlines also feel that President Eisenhower's letter to the Netherlands Prime Minister on March 18 will have considerable effect upon the State Department's attitude in the case. In the letter, Eisenhower said he had "instructed the U. S. delegation . . . to give the most serious consideration" to the Netherlands' request.

Issues at stake in the current negotiations center around the Netherlands government's attempt to obtain commercial rights for KLM into Houston and Los Angeles. Also involved are transit rights through New York on KLM's Netherlands-Curacao route.

The Dutch claim the Netherlands must maintain its place in international air trade to continue as an important and stable anchor of the North Atlantic Treaty Organization.

One of the objections airlines have to extension of KLM's Atlantic route to New York on to Houston and Los

Angeles is that the Dutch can offer nothing in return.

Pan American World Airways already serves Amsterdam and is not seeking additional authority. A spokesman for Trans World Airlines, also a transatlantic carrier, said TWA is not planning to ask for Dutch landing rights because it does not believe the traffic warrants additional airlines.

Tipton testified at last week's meeting that the U. S. policy toward the Netherlands already has permitted the Dutch to build a world-wide air network on U. S. traffic. He said that, in 1955, Pan American took $109,000 in revenues out of Amsterdam, while the Dutch took $12,849,000 out of New York.

The Senate committee's interest in present negotiations also stems from previous agreements signed with Germany. At that time the U. S. government granted Lufthansa, the German airline, a large number of major U. S. facilities. The agreement was bitterly opposed by U. S. carriers.

Greater Airline Voice

The protests led to the introduction of a bill in the Senate to amend the Civil Aeronautics Act to give the airlines and the CAB a greater voice in negotiations. The bill failed to pass during the last session of Congress, but it has been reintroduced.

The bill would limit the powers of the President to act in foreign air matters except where national defense or foreign policy is involved. It also provides that the CAB must notify any air carrier whose interests would be affected and consult with its representatives during negotiations. In addition, it would place a representative of the air carriers on the U. S. delegation during formal negotiations.

The signing of the U. S.-Mexican bilateral on March 7 also brought about increased activity in Washington last week.

While the CAB moved ahead in its selection of carriers to serve the two U. S.-Mexico routes still pending (AW March 25, p. 23), American Airlines announced it would not prosecute its application for the New York, Washington-Mexico City route.

The move left Pan American World Airways and Eastern Airlines sole applicants to provide service. Hearings in this case resume tomorrow.

Instead, American filed a motion with the CAB urging an immediate hearing on its 10-year-old application for nonstop service between Chicago and Mexico City. The airline now operates between Dallas, San Antonio and Mexico City under temporary permission from Mexico. It also operates between Chicago and Dallas under domestic authority and can offer through service to Mexico City from Chicago but not nonstop.

American, through its counsel Howard C. Westwood, said its application to provide nonstop service was filed in 1947 and that at no time since has any competing application for similar authorization been filed.

During this period the U. S. and Mexican governments have been negotiating an aviation agreement. Now that the agreement has been reached, Westwood said there is no basis for further delay.

Immediate Action

The American spokesman said immediate action is needed. Otherwise, he said a foreign flag carrier will step in and place the U. S. carrier at a competitive disadvantage. Westwood said American has been informed that Mexico will move promptly to implement the route granted.

Braniff International Airways is also interested in the Chicago-Mexico City route. In 1946 the airline was granted authority to operate between San Antonio or Laredo and Monterey and Mexico City, but, because of the lack of an agreement with Mexico, it could not implement the service.

Braniff does not have Dallas-Mexico City nor Chicago-Mexico City rights, although it could offer through service between these points as a result of its domestic authority. Under the U. S.-Mexico agreement only one U. S. airline can be designated to serve on each route.

The CAB said it is doubtful whether a decision can be reached on nonstop authority before June 5, the effective date of the agreement. The Board has ordered oral argument between American and Braniff on April 18 to determine which airline should be designated on the Dallas or San Antonio-Mexico City portion.

Airlines already designated by the U. S. to operate over five of the seven routes are:

- **Western Airlines** between Los Angeles and Mexico City via intermediate points in the U. S.
- **Eastern Air Lines** between New Orleans and Mexico City.
- **Pan American World Airways** for three routes from New Orleans to Merida, Mexico, and to Guatemala and beyond, from Houston and Brownsville, Tex., to Tampico, Mexico City and Tapachula and to Guatemala and beyond, and from Miami to Merida to Guatemala and beyond.

Only two Mexican airlines are now operating between Mexico and the U. S. Guest Airlines flies between Mexico City and Miami, while the Mexican Aviation Company operates between Mexico City and Los Angeles. These two, plus Aeronaves de Mexico are bidding for the rights on nonstop flights between Mexico City and New York, Washington, New Orleans and San Antonio-Dallas and Chicago.

Deadline for the Mexican airlines to file a report of their proposed service with the Mexican Communications Ministry was last Thursday. The Ministry will study the reports and announce its decision within a few weeks.

Cubana Orders 707s

Compania Cubana de Aviacion has paid a deposit on two Boeing 707s with J57 engines and has signed a letter of intent to buy two Bristol Britannias.

Aviation Week has learned that the airline expects fall 1959 delivery of the Boeing jetliners for use on its run to New York. Delivery of the Bristol turboprops is planned for mid 1958 and they would be used on Cubana's European route.

Cost of the Boeing order is $12 million.

Opposition Increases To CAB Fare Plan

Washington—Procedures established by the Civil Aeronautics Board to consider proposals by seven carriers for a 6% passenger fare increase is running into mounting opposition.

Among the first to take formal action in protesting the Board order (AW March 25, p. 45) was Northwest Airlines. Northwest, one of the airlines asking for an increase, petitioned the Board for reconsideration or amendment, basing its stand upon arguments advanced by most of the other carriers represented at a pre-hearing conference on Mar. 21.

At the pre-hearing conference, the airlines expressed serious concern over the phrasing of the order which would permit the Board to lower current fares of the seven airlines if CAB found such action justified after investigation.

Such an action would probably force other airlines flying competitive routes but not necessarily involved in the case, to also reduce their fares and could turn the hearings into another general fare investigation.

C. Edward Leasure, Northwest attorney, said in the petition that the proposed fare increase is only an interim relief measure for Northwest pending the disposition of the General Fare Investigation. Therefore, he said, the Board should delete from the order the question of whether the CAB can reduce existing fares and consider only whether or not the proposed increases are justified.

BOEING 707 prototype demonstrates ground handling operations at Seattle. Jet deflector fences were used and sound levels recorded.

Boeing Sets Suppressor Flight Tests

Boeing is accelerating its engine sound suppressor program for its 707 jet transport. The prototype plane will fly early this summer with mufflers of a new design on all four engines. Previously, Boeing indicated that the 707s would be equipped with sound suppressors when the aircraft go into service in 1959.

In addition to the four suppressors scheduled for flight test, the company is building a substantial number of production-type combination sound suppressors/thrust reversers. These will be used for static, taxi and flight tests on the 707 prototype at a later date.

Boeing said that its sound suppressors will involve both a weight increase and power loss. The company says that its newly designed suppressor will reduce the power loss to a minimum.

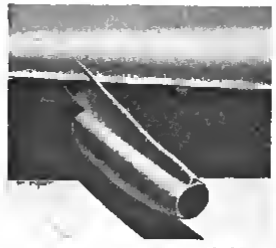
A Boeing spokesman recently told AVIATION WEEK that these other changes will be made to the engine pods of production 707s compared with the prototype:

- **Supporting strut** leading edge will be extended forward to meet the upper lip of the engine air intake. Leading edges of current struts stop somewhat short of the air intake.
- **Turbocompressors** will be installed in pods number one, two and three at the junction of strut and pod. Small air intakes for them will be incorporated immediately above the main engine air intake. Turbocompressors will be made by both AiResearch and Hamilton Standard, according to Boeing.
- **Pod diameters** will be increased slightly to accommodate Sundstrand constant speed alternator drives on all four engines. This will eliminate the bulged fairings appearing on the number four engine pod of the prototype.
- **Engine oil coolers** will be moved from their present position in dead center of the air intakes to location near the lower lip of the pods.

Boeing recently gave a second terminal demonstration at Seattle Airport with its 707 prototype to show how jet transports can be handled at airports. For the demonstration, a simulated loading gate was set up and portable jet deflector fences were used to reduce jet engine noise and blast.

Operational maneuvers, including start up, taxi out, return, park and shut down, were carried out. Nine different parking positions were demonstrated under various power settings and under a simulated full-gross-weight operation of 248,000 lb.

Sound intensities were recorded at various points in relation to the position of the airplane. Noise levels could be reduced considerably by the proper parking maneuver.



PRODUCTION strut/pod of Boeing's 707 jet transport show changes from prototype plane. Strut leading edge has been extended forward to meet upper lip of engine air intake. Small air scoop at base of strut leading edge is for turbocompressor.

EXPERIMENTAL sound suppressor installed on number one engine of Boeing's 707 prototype jet transport. Plane will be flying with new type suppressor on each engine by early summer. Boeing also is building production type suppressor/reversers.

ICAO Members Fail to Agree On Runway Length Requirements

Montreal—International Civil Aviation Organization members have failed to agree on runway length requirements for jet transports despite a warning from U S aircraft manufacturers that high-lift devices will not radically reduce the need for longer takeoff distances (AW Mar 18, p 25)

At a meeting of ICAO's Aerodromes, Air Routes and Ground Aids Division, some technical experts said that, despite the manufacturers' warning, boundary layer control and jet flaps will eliminate the need for extending runway lengths to handle jet transports Some advocates said high-lift techniques would result in 'landing and takeoff speeds only one-quarter as large as the present ones "

Earlier, a Douglas Aircraft official admitted that moderate gains in landing distance can be expected from boundary layer control He added, however:

"This does not particularly affect the problem at hand, since for ranges above 2,000 nautical miles, the takeoff distance defines runway requirements."

The Douglas official said his company does not see an effective use of boundary layer control during the early years of jet transport and that any advantages attained will be used to reduce seat-mile cost rather than airport length

His views were echoed by Convair, Lockheed and Boeing officials prior to the ICAO meeting A Boeing representative reported that the newer high-lift concepts show certain advantages "in that for a given weight shorter takeoff can be accomplished but only at the expense of range or payload capability"

Lockheed said lift ability will be increased by these techniques but that gains will be used for greater range, more endurance for holding in weather and higher cruising speed

Convair said STOL concepts will be incorporated in military aircraft first and that application to commercial transports will follow only after a significant development period

At the ICAO meeting the U S manufacturers agreed that runway extensions would be required only for the use of long-range, full-loaded jet transports and that most turboprop and medium-range turbojets will be able to operate from existing airports

Participants of the meeting also concluded that strengthening of runways will be necessary only at airports where the long-range jet transports will operate

Despite the increased weights of the smaller turboprops and turbojets, the use of multiple undercarriage wheels is expected to spread the load of the aircraft over the runway to lessen initial impact

Mediterranean Needs Cited in ICAO Study

Montreal—Air navigation facilities and services in the European-Mediterranean region generally have been brought up to International Civil Aviation Organization standards but critical deficiencies still exist Southern Europe and the Mediterranean basin are the most critical areas, ICAO declares in a report by its special task force on the region's needs

ICAO's panel found that the area under study requires a particularly efficient network of navigation and traffic control facilities and services This is true because of the large volume of civil air traffic intricate air route networks, intermingling of military and civil traffic, and the approach of large scale jet transport operations Airports generally meet the requirements of ICAO's regional plan the panel reports and some will be expanded to meet jet needs

A major problem was found in communications in some areas Telecommunication delays between control centers under the worst conditions ranged from two hours to over eight hours

Another deficiency was found in the absence at a number of airports of needed lighting The panel recommends that governments give high priority to provision of approach and runway lights for increased safety and regularity of operations

Inadequacies in upper wind forecasting also were reported by the panel, and it was pointed out that such errors will be even more serious with the advent of jets

Panel recommends more regional cooperation in upper wind forecasting with the work being more equitably distributed

Further recommendation was made for improvement in training of air traffic control personnel, from the standpoint of thoroughness and uniformity

Route Deviation Cited In Medicine Bow Crash

Washington—Deviation from the planned route was listed by the Civil Aeronautics Board last week as the probable cause of a United Air Lines C-54B-DC crash into Medicine Bow Peak, Wyo, on Oct 6, 1955

The CAB investigation report on the accident said the pilot's reason for the deviation had not been determined

The flight originated in New York and was en route to San Francisco with intermediate stops in Chicago, Denver and Salt Lake City Fifty-three minutes after takeoff from Denver the plane struck the top of Medicine Bow Peak at the 11,570-foot level, about 21 miles west of the prescribed course. All 63 passengers and three crew members were killed

The crew consisted of Capt Clinton C Cooke, Jr, Ralph D Salisbury, Jr, first officer, and Stewardess Patricia D Shuttleworth

Examination of the recovered sections of the aircraft failed to indicate any fire, structural failure or malfunctioning of the plane or its components prior to impact, the CAB revealed

Witnesses who testified that they saw the transport in flight said the aircraft did not appear to be more than 500 or 600 ft above a logging camp 9,600 ft up the mountains They said it appeared to be operating in a normal manner

The CAB report said the direction of the flight path, indicated that either a shortcut was being attempted when the accident occurred or that the crew was incapacitated and the aircraft flying without assistance

The Board said it is difficult to understand how a pilot of Capt Cooke's experience would deliberately attempt a shortcut and, if he did so, why he would have flown at such a low altitude over hazardous terrain

Also, weather over the planned course was better than the one taken and Captain Cooke had not advised the dispatcher of any intended deviation from the filed flight plan

Incapacitation of the crew cannot be completely ruled out, the Board said, although it appears unlikely. There is a possibility however, the CAB said, that the cockpit heater could have been defective and that dangerous gases could have entered the nosewheel well and into the cockpit by means of the ground blower

Resort Super Constellation

First of two Lockheed 1049H Super Constellations on order by Resort Airlines will be delivered in May Five other airlines have ordered 20 of the cargo/passenger convertible model Resort will receive second 1049H in June.

SHORTLINES

►**American Airlines** has added third daily transcontinental all-cargo flight. New DC-6A service provides roundtrip between New York and Los Angeles

►**British Overseas Airways Corp.** will introduce its DC-7C on route from Chicago and Detroit to Glasgow and London on April 3 Planes replace Stratocruisers on the run.

►**United Air Lines'** maintenance work at San Francisco base involved 4,300,000 man hours during 1956, an increase of 11% over 1955. Facility overhauled 241 airframes and 1,465 engines

►**Big two meeting** menu at Bermuda conference last month included 12 grouse, 12 pheasant, 12 Hungarian partridges, 12 mallard ducks, assorted antelope steaks flown in by Trans Canada Air Lines

►**Chicago Helicopter Airways** has scheduled hourly passenger flights between downtown Chicago and Midway and O'Hare airports Airline expects delivery of first of three S-58s this month, is now using S-55s

►**Braniff International Airways** has broken ground for new $6.5 million maintenance base at Dallas Three-story main building will cover six acres, han-

AIRLINE OBSERVER

►Look for increased orders for medium-range jet transports from major U S trunk lines At least one U S carrier after completing a detailed analysis of turbine-powered transport performance in relation to its routes and traffic pattern, has concluded that it will need three new types of transports, a long-range turbojet, medium-range turbojet and a workhorse turboprop

►**Canada will build a $650,000 VHF forward scatter station near Gander Airport, Newfoundland, as part of a proposed North Atlantic network that will include one voice channel and four teletypewriter channels between Gander, BW-1 Greenland, Iceland and Prestwick/Shannon System is the result of recommendation by International Civil Aviation Organization calling for collective action by all governments whose airlines fly the Atlantic to improve air traffic control and communications in the North Atlantic regions.**

►Civil Aeronautics Administration will begin controlling all airspace above 24,000 ft within the next 60 to 90 days Administrator James Pyle has set January, 1958, as target date to lower the control floor to 15 000 ft

►**Rolls-Royce delegation headed by Managing Director James Pearson is visiting U S transport aircraft manufacturers in an intensified campaign to sell the 10,500 lb. thrust RA 29 Avon and the 13,000 lb thrust Conway by-pass engine**

►American Airlines has signed a contract with the Electronics Division of Curtiss-Wright Corp for flight simulators for the Lockheed Electra and Boeing 707 Earlier agreement with Erco Division of ACF Industries (AW Feb 4, p 49) was canceled by mutual consent because military contract priorities would delay delivery of commercial simulators until after delivery of the turboprop and turbojet transports

►**Bill has been introduced in the Texas legislature that would give the State Railroad Commission control over airline operations in Texas. The agency, which regulates surface transportation and the petroleum industry, would have power to certificate airlines for common carrier and contract operations and would have authority to set rates for airline service in Texas. Odds are against the bill being passed.**

►Lack of suitable engine development is stalling Douglas and Boeing plans to proceed with solid offers of a medium range jet transport Both companies are interested in the Pratt & Whitney J52 but Douglas is also considering a de rated version of the General Electric J79 for its DC-9 project

►**Despite the high pressure sales campaign spearheaded by Peter Masefield, managing director of Bristol, the Britannia is no longer regarded as a serious competitor in U. S domestic airline equipment plans.**

►Bell Aircraft Corp will brief airlines and financial experts on its all-weather landing system (AW March 4, p 32) in the near future Briefings already have been presented to Presidential Advisor Edward P Curtis, Civil Aeronautics Administrator James T. Pyle and their technical staffs. The Curtis group is scheduling a visit to the Bell plant to study the system in actual operation CAA is interested in the landing system but feels that far more pressing air traffic problems hold first priority Both groups want further evaluation of the system for long-term planning

►**Airlines serving Honolulu International Airport have banded together as the Airport Users Assn in a move to seek reduction or repeal of Hawaii's 4½ cent tax on each gallon of aviation fuel The group is urging adoption of landing fees in lieu of the tax.**

►Convair engineers have completed evaluation of landing gear proposals for the 880 jet transport from Bendix, Cleveland Pneumatic and Menasco. Proposals with recommendations have been forwarded to the company's purchasing department for decision.

dle six DC-7s. City of Dallas is financing project under 30-year lease agreement with Braniff.

▶ **Curtiss-Wright Corp's** Electronics Division will build American Airlines' Electra and 707 simulators. Preliminary agreement between airline and Ercoupe Division of ACF Industries was terminated because of ACF's military priorities.

▶ **Seaboard and Western Airlines** has declared 4% stock dividend, bringing total of common shares outstanding to 998,192. The airline flew 1,112,000 transatlantic all-cargo ton miles in February, an increase of 111% over February 1956.

▶ **Emery Air Freight Corp.** earned $1,184,000 before taxes in 1956, up from $773,000 for year before. Revenues totaled $9,302,000, up 25%. Net 1956 income was $567,000. The freight forwarding firm paid 35 cents a share cash dividend in 1956, plus stock dividend of 2%.

▶ **Allegheny Airlines** flew 4,418,000 passenger miles in February, up 26% from same month of 1956. Carrier says new record was achieved despite worst Middle Atlantic states area weather since its service began in 1939.

▶ **Sabena Belgian World Airlines** has produced a handbook of tours for public distribution at $1 copy. The 144-page, color "Holiday Abroad—1957" lists 80 itineraries, other information for the transatlantic tourist.

▶ **Western Air Lines** claims commercial Los Angeles-Salt Lake City record of 1 hour, 50 min. in DC-6B. Plane hit 380 mph during 620-mi. run, cut 45 min. from scheduled time.

▶ **Trans Australia Airlines** is importing its second Hiller 12 helicopter. First Hiller 12 was damaged in forced landing in Northern Territory and is being repaired at Melbourne. Another helicopter soon to reach Australia will be used by Zinc Corp. in geological survey work.

▶ **Flying Tiger Line** has declared semi-annual dividend of 25 cents per share.

▶ **United Air Lines** has asked California Public Utilities Commission to approve 6% across-the-board fare increase for intrastate operation. UAL has asked CAB to approve same hike in intrastate and international service.

▶ **Trans Australia Airlines** claims highest Viscount usage of any operator. Airline says it averages 3,200 hr. a year on its Vickers turboprops.

COCKPIT VIEWPOINT

By Capt. R. C. Robson

How to Hire a Pilot

A recent letter to the editor (AW March 11 p. 146) from an unnamed Air Force pilot complained of the procedures used by the airlines in selecting new copilots. In case you felt that this officer was complaining unnecessarily, or was an unusual case, let me add—not at all. Airline hiring methods are not only arbitrary—which they probably have a right to be—but many times downright puzzling.

I can sympathize with this pilot for I was once turned down by a major airline for exactly the same reason—too short. I'll bet I can even name the same airline in the same southern city. My advice to this pilot is to simply ignore what happened and walk across the street. They are all different and as far as I know not much can be done about it. If its any comfort, airline pilots continually gnash their teeth when a particularly good prospect whom they have recommended is turned down for one of these flimsy excuses.

Good Way to Hire

Once upon a time you got yourself hired by a chief pilot. You stated your qualifications, had a man-to-man talk, and he sized you up. Later you had a brief spin in a Link, a bit of ground schooling (to make it legal) and then were assigned to a captain for further observation. Judging from the results this was a pretty good way to hire. But not any more.

Now an airline is Big Business. Most of them have a personnel department to hire everything from dishwashers to future managers of multi-million dollar pieces of airplane. Only trouble is the hiring people seem to make no differentiation. There are not many chief pilots these days who have the power to hire. They can only recommend just as you and I and these recommendations can be ignored.

Here are some cases of which I have knowledge. The son of the number one pilot of a major airline, reared in the glory of his father's company and obviously slated to follow the paternal footsteps, was turned down by dad's alma mater because of one of those "psycho" tests. Ditto a Marine major, a veteran of World War II and Korean combat. Ditto a former CAA multi-engine examiner, 10,000 hours flying time and former manager of a large airport. Each of these cases simply walked across the street. As far as I know they are doing fine.

Weird Tests

In order to justify their occupations the people in charge of hiring have resorted to all manner of weird tests. These are known by an assortment of hilarious, and generally unprintable, names among the pilots. The behef of personnel is that the tests weed out the misfits. Apparently it doesn't matter that they also weed out some splendid stock. If the test says "out," then out you go and the hiring clerk's conscience is clear.

Do you know which make of motorcycle has the gear shift on the left side? Or on what floor of the department store you find ladies' lingerie? Or what is the color of the No. 2 ball on a pool table? Well you'd better. That's the stuff they're interested in these days.

To be perfectly honest, I would not recommend a total stranger for an airline job because I might meet him again. Past embarrassments at such meetings and hearing all about it are still fresh in my mind.

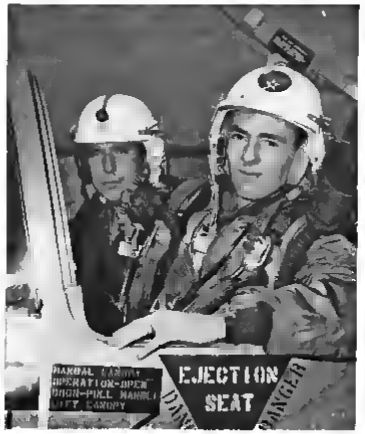
Just to get the record straight, and if it's any comfort, the airline pilots are on your side. Unfortunately there's not much we can do about it until you get to fly with us except perhaps to apologize for what others have done. And even then it will take you several years to get over the shock of your hiring treatment—just like it will for this unnamed letter writer.

Airline Traffic—January 1957

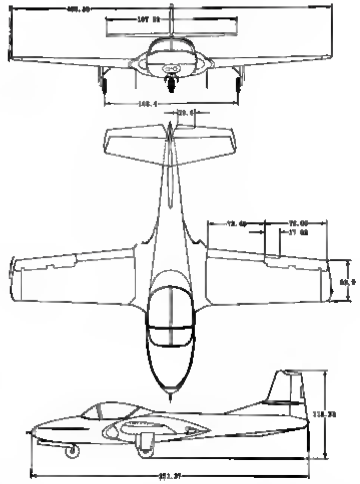
	Revenue Passengers	Revenue Passenger Miles (000)	Load Factor Per Cent	U. S. Mail	Express	Freight	Total Revenue Ton-Miles	Per Cent Revenue to Available Ton-Miles
DOMESTIC TRUNK								
American	574,661	400,426	64 8	1,696,701	927,367	6,446,807	47,612,530	59 0
Braniff	157,896	67,882	58 8	242,317	141,898	286,288	7,178,762	47 2
Capital	266,482	98,508	57 8	297,616	170,071	247,713	10,138,726	66 5
Continental	60,828	22,695	54 7	72,752	23,881	97,556	2,373,777	65 9
Delta	215,716	111,051	57 51	354,758	297,434	544,552	11,897,506	52 82
Eastern	608,588	376,887	58 01	960,284	425,381	1,253,993	39,073,303	42 34
National	138,261	98,779	59 2	320,064	69,805	462,378	10,742,985	49 5
Northeast	37,238	8,746	61 2	11,093	16,460	17,974	883,757	38 8
Northwest	93,612	64,512	54 95	355,809	235,265	619,226	7,403,375	48 00
Trans World	330,283	264,966	62 2	1,021,915	793,325	1,861,223	29,135,415	55 7
United	484,483	334,239	62 31	2,280,433	1,037,822	4,171,554	39,590,158	56 96
Western	103,598	51,556	63 0	252,027	98,484	165,518	5,455,722	88 3
INTERNATIONAL								
American	11,181	9,277	65 8	12,063	472	24,161	1,276,123	69 9
Braniff	2,771	6,064	48 9	25,194		78,654	796,090	54 9
Caribbean Atlantic	20,112	1,467	53 15	1,394		3,133	276,726	57 91
Delta	5,663	6,475	59 25	6,410		47,001	773,677	59 25
Eastern	23,415	31,670	71 14	73,828		77,071	3,427,624	59 85
National	9,691	6,340	54 2	9,432	4,737	21,445	784,222	53 0
Northwest	8,212	18,076	51 18	943,366	22,187	560,408	3,437,615	50 32
Pan-American								
Alaska	4,437	5,047	48 5	30,801		158,630	719,521	43 7
Atlantic	58,747	78,518	55 5	1,087,379		2,065,921	11,561,167	56 3
Pacific	20,524	76,183	68 5	954,639		1,706,900	10,575,023	63 2
Latin America	103,550	101,307	63 2	387,030		3,273,214	13,619,405	62 1
Panagra	11,464	14,068	58 7	57,066		266,147	1,822,823	57 6
Trans World	12,765	33,563	56 3	773,231		710,096	5,083,753	63 8
United	6,403	15,897	56 59	81,053		52,838	1,763,458	51 81
LOCAL SERVICE								
Allegheny	26,393	4,477	61 6	7,001	17,252	7,693	659,844	39 5
Bonanza	10,982	2,496	48 7	4,189	2,434	6,551	232,042	65 2
Central*								
Frontier	15,871	4,618	47 4	18,280	6,974	47,169	513,289	58 8
Lake Central	10,604	1,726	42 9	2,452	11,613		179,026	39 0
Mohawk	28,324	5,329	49 1	4,919	10,724	12,967	537,118	49 4
North Central	46,725	7,350	45 3	19,173	31,413		732,111	45 3
Ozark	25,356	3,889	35 65	9,444	16,558	9,208	406,915	37 83
Piedmont	26,006	5,481	67 5	11,550	9,684	11,560	558,277	47 4
Southern	16,023	2,808	62 7	8,490	10,516	2,113	287,583	40 4
Southwest	23,532	5,101	67 2	8,774	4,651	7,291	506,865	45 7
Trans Texas	17,402	3,994	39 16	12,446	8,215	20,625	423,078	38 30
West Coast	16,516	2,959	40 66	4,133	1,934	3,198	291,844	39 49
HAWAIIAN								
Hawaiian	29,378	4,505	54 2	3,829		95,034	494,350	55 3
Trans Pacific*								
CARGO LINES								
Aerovias Sud-Americana						626,571	626,571	79 6
Flying Tiger	3,879	20,628	99 4	34,714		58,790	4,994,281	78 1
Riddle				40,164	36,765	2,418,375	2,695,304	67 37
Seaboard-Western	7	2,008	150 00			1,102,500	1,303,349	61 7
Slick	4,579	16,977	92 85	75,453	92,338	4,580,153	6,445,672	70 92
HELICOPTER								
Chicago Helicopter	1,063	16 7	26 6	2,335			3,963 6	34 2
Los Angeles Airways	2,080	83	38 2	3,990	2 154		14,275	58 4
New York Airways	3,960	76	35 0	1,113†	992	465	9,842	39 7
ALASKAN								
Alaskan Airlines	3,587	1,081	40 7	21,840		130,244	255,995	44 1
Alaska Coast	2,676	239	61 44	3,529		2,983	30,743	82 58
Cordova	695	98	29 3	3,099		24,372	37,662	46 0
Ellis	2,317	150	56 3	1,538		1,788	18,616	67 8

* Not Available.
† Mail transferred in bulk.
Compiled by AVIATION WEEK from airline reports to the Civil Aeronautics Board.

CESSNA'S 6,400 lb. T-37A trainer powered by two J69s can land, takeoff on 2,000 ft. runway. Single-engine performance is good.



AVIATION WEEK Editor Robert Stanfield (right) in T-37A cockpit with civilian instructor Homer Walters.



Aviation Week Check Ride:

Evaluation Shows T-37A Is Fast, Simple, Compact

By Robert L. Stanfield

STUDENT sits on left side, instructor right. Navigation and flight instruments are positioned on student's side, engine instruments above throttle pedestal. Radio controls are in front of the instructor, but are within reach of the student.

Waco, Tex.—Designed to become a vital link in USAF's all jet crew training program, Cessna's new twin-jet side-by-side T-37A primary trainer is a fast, compact, easy-to-handle airplane, a recent flight evaluation here by AVIATION WEEK indicated.

With some modification, including tip tanks for additional range, extra seating and pressurization, it could be the forerunner of a four place executive jet transport. Although Cessna will not say so officially, indications are that such a configuration has come off the drawing boards at Wichita, Kan.

First Group

For a first-hand evaluation of the T-37A's characteristics, an AVIATION WEEK editor flew to Flying Training Air Force Headquarters, where since Jan. 7 the initial group of production trainers has been undergoing in the field trials at James Connolly AFB, near Waco.

Flight checks by AVIATION WEEK showed that:

- **T-37A can easily** get into and out of a 2,000-ft. runway with lightplane performance, despite cruise speed in the 300-kt.-plus category.
- **Good single-engine** characteristics were evident, with little or no trim.
- **Good balance,** controlwise, through all speed ranges was noted.
- **Thrust reduction device,** developed by Cessna, permits approaches to be made at high rpm, providing a safety margin in event of go around.

Practical trials of this new airplane under field conditions also have revealed inevitable "growing pains." Among these, now being studied by the manufacturer:

- **Temporary grounding** of the trainers at this base because of problems with the Continental J69-T-9's fuel system that passed JP-4 into the engine (AW Mar. 18, p. 28).
- **Pilot dissatisfaction** with communications equipment installation, weak signals being the primary complaint. An unsatisfactory report may be made by USAF on this item.

The little trainer, which grosses 6,400 lb.—zero fuel weight is 4,400 lb., not much more than an automobile—is powered by two 920 lb. thrust Continental J69s. Engines are modified French Turbomeca Marbores and will turn up 22,700 rpm., plus or minus 50, at 100% power. Dry weight of the engine 364 lb., with starter and generator, 394 lb.

Airplanes flown by AVIATION WEEK in its flight evaluation were serials 55-4319 and 54-2738. Latter was the 14th built by Cessna. The 34th T-37A was rolled off the Cessna production line while Aviation Week's pilot was flying the airplane. Accompanying the pilot on flights were Capt. Stanley R. White, assistant maintenance officer of Project Palm, and Jim Boyle, chief of Cessna's production flight test.

Cockpit and Controls

USAF favors side-by-side seating in T-37A for two reasons:

- **Student confidence builder.** With instructor alongside, student can be more easily indoctrinated with jet techniques and procedures.
- **Ease of instruction.** Instructor can observe student at all times, be "ahead" of him in all phases of flight training, without having to resort to guesswork.

Controls are easily accessible from either side of cockpit. Stick grips and throttle quadrants are fighter type. Four throttles are provided, two for each quadrant. Throttle movement mechanically actuates each engine fuel control by means of push-pull rods and torque tubes.

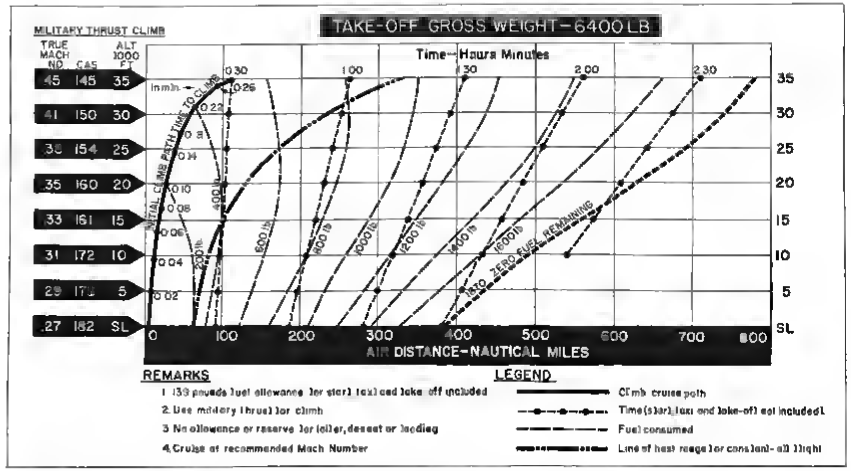
Lift type idle detents are included on instructor's quadrant to prevent inadvertent positioning of either set of throttles from idle to cut-off. There is no deicing equipment, but an engine ice warning light, on instrument panel, will illuminate when ice forms over the ice-detect probe in left engine air inlet duct.

Positioned on the left, on student's side, are navigational and flight instruments, including directional and altitude indicators, altimeter, turn and slip, rate of climb and airspeed indicators, course indicator (omni), and clock. Engine instruments set over the center quadrant, include tachometers, exhaust temperature indicators, fuel flow indicators, oil pressure gages, loadmeters, accelerometer and fuel quantity indicator. In front of the instructor, on the right but within reach of student, are radio controls, circuit breaker and instrument panel, a c fuses, plus airspeed and turn and slip indicators, and altimeter.

Two D-2 automatic pressure-breathing diluter-demand oxygen regulators for both student and instructor are located on lower left and right side of instrument panel.

T-37A incorporates a simple cockpit check. Airplane can be started on its own battery or external starter (APU), six to 10 starts can be made on former. Standard starting procedure is: Battery and inverter on, fuel pump on, open fuel shut-off valve for left engine, push up on starter switch and hold, at 5% rpm. push up on ignition switch and hold, bring throttle forward to idle, release starter and ignition switches at 22% rpm. Engine will idle at 35%. Same procedure is used to start right engine.

Airplane's taxi and flight characteristics are good. Power steering is acti-



PERFORMANCE graph for T-37A shows range and endurance at speeds from Mach .27 to .45 and altitudes from sea level to 35,000 ft

vated by button on stick, and slight rudder pressure steers airplane neatly and quickly. Nose wheel will steer on free swivel to 50 deg. Large transparent canopy allows excellent visibility during taxi and flight.

Before takeoff there are two safety pins for the student to pull and one for the instructor. One of the pins is for canopy jettison and one for student's ejection seat. The instructor's pin is for his ejection seat. Before aircraft is entered, ground crew removes a fourth jettison pin for canopy behind and beyond reach of pilots.

A "hot" mike, geared to the new P-4 helmet, enables instructor and student to talk—without button pushing—from time electrical power is turned on until engines are shut down.

At takeoff, with wind of 15 kt., rpm was run up to 100%, full acceleration taking about 13 seconds. No engine warmup is necessary. Below 6,000 ft engine must accelerate from idle rpm to 100% within 15 seconds, above 6,000 ft there is a 30 second allowable limitation. Brakes were then released and aircraft went swiftly down the runway, half flaps lowered.

The T-37A went off smoothly at 85 kt. after a run of about 1,700 ft. Airspeed had increased to 190 kt. indicated by the time we reached the end of the 7,000 ft. runway. With power retarded to 97%, normal rate of climb was 2,000 fpm. Visibility remained excellent. Little sink was evident when flaps were raised.

At 3,000 ft., pulling 92% power (cruise), airplane indicated 288 kt. Reducing power to 62%, speed of 100 kt.—minimum safe single engine airspeed—was obtained. At 4,000 ft., pulling low cruise power of 82%, the aircraft indicated 225 kt. During climb, in level flight and turns at varying speeds, we noted that aileron control and stability were good.

Single Engine

Both left and right engines were cut at low altitudes. With 92% power on good engine, 175 kt. was easily held. No trim was necessary. Yaw was negligible and only slight rudder pressure was applied. Airplane was smoothly rolled both left and right on single engine.

Climb to 25,000 ft. took about 15 min. Controls remained light during climb and only minor trim adjustments were necessary.

At 10,000 ft. pulling 100% gave CAS reading of 305 kt. for TAS of 355 kt. or 409 mph.

During vertical climb to 15,000 ft. airplane was rolled around twice during ascent, pulling 3½ Gs.

T-37A was stalled cleanly at 13,500 ft. with left engine out, 93% power on right. Buffeting occured well ahead of stall and altitude loss was negligible. The airplane mushed along. Hands off

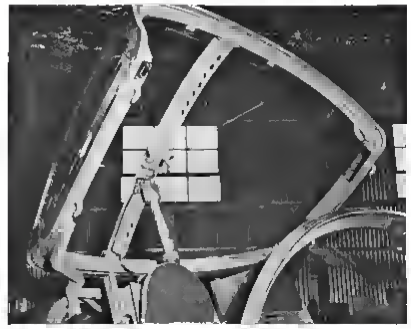
Jet Training

Waco, Tex.—Cessna T-37A evaluation and indoctrination of personnel, coded Project Palm, embraces upgrading of 10 top civilian instructors from the nine contract schools conducting USAF primary flight training. These instructors will remain at Waco until November, helping Flying Training Air Force "write" its student training program covering the new jet.

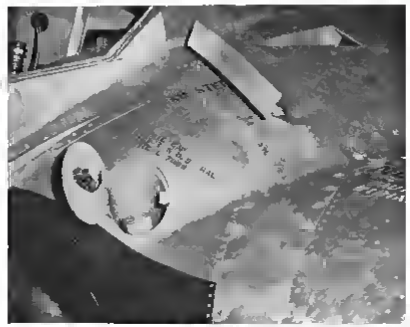
First class of 20 students, of which 14 are now training here, will get 150 hr. in the T-37A. This will later be pared to 100-110 hr. at the contract schools. These 14 students have received 40 hr. in the piston-powered Beech T-34A; the second group of six, starting T-37A training March 25, will have 20 hr. in the T-34A. Both groups will take identical courses on the jet, running until November, during which FlyTaf will determine future T-34A screening requirements.

It is possible that students will eventually start their flight training with the T-37A under FlyTaf's plan to complete an all-jet curriculum by 1960. In October, the Lockheed T-33A jet trainer begins replacing North American TB-25s at multi-engine basic schools. In turn, the T-33A will be replaced by the supersonic Northrop T-38. Future plans call for 110 hr. in the T-38 followed by assignment to Crew Training Air Force for operational training in Century Series fighters, the B-52 and B-66.

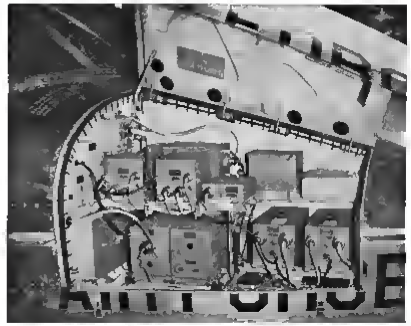
THRUST attenuator, hydraulically operated reduces effective thrust, maintains constant rpm



FOLDED V shaped dipole antenna is visible with canopy open. Antenna is for Omni system



SPOILERS on top of nacelle behind intake create buffet warning at low speed. Fuel filler is open.



T-37A radio gear is installed ahead of cockpit on right side. USAF complains of weak strength

wing fell into dead engine only slightly.

At the same altitude, speed brake out, gear down at 150 kt. and full flaps at 130, landing configuration stall was entered. Again there was buffeting well in advance of stall, which occurred at 60 kt. indicated. Lateral control throughout stall was good. Recovery showed loss of 300-400 ft.

Buffeting is created by spoilers on top of each engine nacelle, actuated to "up" position when aircraft reaches 75 kt. while flaps are extended 10 deg. or more. When up, spoilers create buffeting 3 to 15 kt. above landing configuration stalling speed. Increasing speed or retracting flaps will return them to down position.

Most high speed jets get pronounced pitch up effect with speed brake. The higher the airspeed, the more pitch-up. Trimmed up at 12,000 ft., indicating 300 kt., hands off, the T-37A's speed brake was applied. Pitch was negligible.

At 20,000 ft., pulling 92%, cruise speed of 225 kt. IAS was obtained for a TAS of 300 kt. or 354 mph. Cruising range of T-37A at this altitude approximates 800 nautical miles.

Aircraft controls were well balanced throughout all speed ranges. No boost or artificial devices are incorporated. Limit speeds are 382 kt. below 10,000 ft. and Mach .7 above 10,000 ft. Until static tests are completed G limits run from plus 5 to minus 1.9. Most student work will center at about 20,000 ft.

Spin Characteristics

Cessna controls T-37A's spin characteristics with "spin strakes" on both sides of airplane's nose, running toward leading edge of each wing. Strakes are 2 in. wide, each strip runs 74 in. in length. Object is to dampen flow of air around nose of airplane, resulting in slower and steadier spin.

Prior to spin, wing fuel quantity was checked and found to be within balance limits. With its wings full of fuel the airplane has wide lateral loading. Uneven distribution gives great weight unbalance, especially for a spin. Unbalance may occur in flight by variations in fuel system performance.

If difference exceeds 100 lb., balance may be obtained by turning on emergency system and skidding fuel back into light wing.

T-37A was spun from an altitude of 20,000 ft. Both engines were idled back, full back stick was applied and full left rudder.

The trainer spun normally to the left; nose first high, then lower and steady by second turn. After three turns hard opposite rudder was applied, after another half turn the stick was briskly shoved forward.

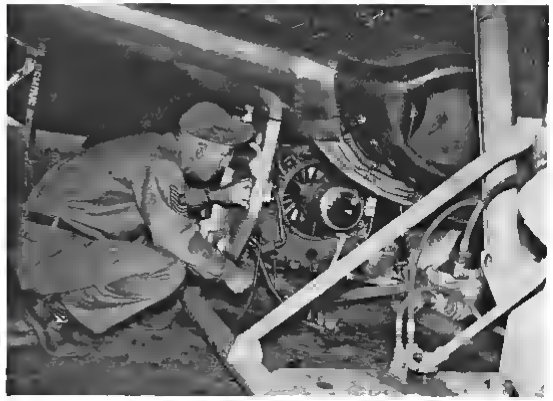
With the full down elevator, the aircraft nosed down at steeper angle and we lifted in our seats, but recovery was fast in slightly over a turn. Altitude loss was about 500 ft. per turn. Including

recovery from dive, aircraft dropped to 16,000 ft.

If recovery procedure is not executed briskly, or if full pro spin controls are not held during the spin, there is good possibility of rapid increase in steepness and rate of spin. Brisk application of pro spin controls will be necessary to allow the nose to come up and rotation to slow down. Failure to allow aircraft to resume normal spinning attitude may result in a second unsuccessful spin recovery attempt.

Landing via pitch-out was made with initial approach speed of 220 kt. IAS, using 82% power. Speed brake and thrust attenuators were applied in pitch out as power was reduced to 60% speed to 150 kt., and gear was lowered during 180 deg. turn.

Speed brake and thrust attenuators operate hydraulically through one system, using separate control valves. Speed brake, located on bottom side of nose section, functions to reduce air speed, thrust attenuators, located in aft fairing of each engine nacelle, reduce effective thrust and still maintain a constant rpm. Thrust attenuators will automatically close when throttles are advanced past 70% rpm. Speed brake will remain out until switch is positioned to



J69 IS QUICKLY REMOVED from T-37A using a special hoist which hooks onto the engine through the top of the nacelle and then lowers it onto a frame under the trainer.

ENGINE MAINTENANCE is eased by placement of large, quick-remove access panels around the powerplant section. J69s are an Americanized version of French Turbomeca Marbore.

"in," as will thrust attenuators after landing.

Full flaps were dropped at 135 kt., on base leg, speed was reduced to 120 kt. Final approach was made at 100 kt., throttles still set at 60%. Touch down was made at 75 kt.

A conventional pattern was flown on the next trial. Aircraft was pulled off at just over 60 kt. IAS in about 900 ft. with half flaps. With 73% power, gear was lowered on downwind leg and IAS reduced to 130 kt., 110 kt. was base leg speed.

Speed on final approach dropped to 100 kt., 85 over the fence and about 70 kt. at touchdown. The T-37A was turned off at 1,700 ft. intersection.

Airplane communication is via UHF-VHF ARC Type 12, normally used in helicopters and liaison aircraft. Output of VHF transmitter is only 2 watts, and UHF transmitter only ¼ watt, compared with 10 to 20 watt transmitters in most USAF equipment. Though range supposedly is 60 mi., USAF towers usually are difficult to pick up. And if tower operators should increase their volume to receive the T-37As, stronger voice transmissions from other aircraft will come blasting in.

This situation is expected to improve when aircraft begin operating from their own bases.

The P-4 helmets now used have low impedance headsets and dynamic microphone. This necessitates use of MX1646/AIC adapter using transistors in mike circuit and impedance matching transformers for head sets. Adapter, when new, works with intercom as well as expected. When it has aged slightly and changed value, intercom is too weak, according to USAF technicians, yet normal reception (power output) from receiver is adequate.

Course Indicator

For navigation, the trainer is equipped with an R-20 marker beacon receiver and ARC Type-15D Omni. Omni consists of R-13B receiver with D-10A dynamotor, a B-13 converter, a control unit and a course indicator. Pilots have indicated dissatisfaction with strength of unit which possibly could result from shielding created by aircraft. Folded dipole antennae, "rabbit ears," are located in canopy.

USAF has indicated it will file an Unsatisfactory Report on the communications equipment.

Pilot opinion varies as to replacing omni with ADF. During cross-country, not all bases would be within range of Omni, which couldn't be used for holding over range, beacon, etc. Student returning from cross-country could also orientate faster with ADF should weather be marginal or less. Difference in weight of equipment would mean sacrificing aircraft performance, plus

USAF F 104 Starfighter, the "Missile With a Man in It."

IF, AS YOU REAO THIS, YOU SHOULD HEAR A LOCKHEED F–104 STARFIGHTER FLYING OVERHEAO, DON'T BOTHER TO LOOK FOR IT. THIS WORLO'S FASTEST JET WILL BE OUT OF SIGHT BEFORE YOU CAN FINISH REAOING THESE FEW WOROS.

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West German Sea Hawks

Hawker Sea Hawk Mk. 4 carries markings of West German naval air arm. Germans ordered 68 Sea Hawks with spares and equipment valued at more than $14 million. Order will help Armstrong Whitworth, which was hard hit by RAF cancellations. Germans, who have no major warships, will use Sea Hawk for patrol and reconnaissance. Germans also are expected to order 16 Fairey Gannet anti-submarine aircraft for $7.2 million.

USAF's desire to teach students use of Omni.

Growing pains encountered during Training Command's evaluation did not skip the powerplant.

JP-4 fuel totaling 309 gal. is carried in wings and in fuselage. Six interconnected fuel cells in each wing hold 111 gal. and one 87-gal. fuel cell located aft of the cockpit wall forms the fuselage fuel tank.

Fuel used by both engines is taken from fuselage tank which is replenished from wing tanks.

Normally, fuel from wing tanks flows by gravity to two interconnect shutoff valves. With shutoff valves closed, fuel from wings is directed to a fuel proportioner pump which transfers equal quantity from each wing to fuselage tank. Once fuel has reached fuel controls, throttle settings determine amount of fuel each engine will receive.

Main problem with the J69-T-9s is fuel control, most of which occurs at over 20,000 ft. Where controls have been satisfactory during ground check, high altitudes will show discrepancies in required rpm.

Fuel leakage is another problem being worked out by Continental. In several instances machined fuel distributors have cracked. Fuel after shutdown passed back into slinger and out into engine, causing billowing fuel clouds out of engine and exhaust.

The engines generate a high pitched whine necessitating ground crew use of ear plugs and muffs. Noise in the air is negligible.

During the next six months Cessna will be studying the powerplant for improvements or modifications. This will include inlet duct, fuel control and tailpipe installation. Continental also plans to increase thrust of engine to 1,020 lb. Present mechanical hydraulic nosewheel steering may be replaced by electrical hydraulic steering.

Cessna also is working on better antenna installation to improve radio and better braking action to smooth out grabbing. Present compass will be replaced by J-2 flux gate. Company is proposing that shielding be placed around oxygen cylinders, located in forward part of tail cone, to protect the cylinders from hydraulic line ruptures.

Thrust attenuator and speed brake may be replaced with one drag device in order to further simplify the airplane and reduce weight. Cessna could, if necessary, modify the T-37A with tip tanks to increase range. This is not necessary for the trainer's present mission, according to USAF.

Air conditioning will go into aircraft this spring for summer and fall deliveries.

Boot-strap system will take bleed air off compressor, feed it through turbine so it expands. Expansion cools air, which is dumped into cockpit.

Non-stressed areas of the T-37A, such as lip of inlet duct, wing tips, leading edge on top of vertical stabilizer, ram air inlet scoop, etc., are of Fiberglas with rubberized anti-erosion coating.

Cessna's present USAF contract exceeds $48 million will carry through to August of 1958 and involves, roughly, 300 aircraft.

Currently company is producing six per month; by mid-July this will have increased to 17 a month.

Radar Contract Awarded For USAF Test Center

Electronic Engineering Co. of Los Angeles received $1.4 million contract for installation of radar instrumentation equipment in Elv, and Beatty, Nev., areas for Air Force Flight Test Center. In addition to electronic research and development, award includes construction of roads, buildings and other installations.

Honeywell Gyros

FOR EVERY AIR-BORNE JOB

No mass-produced device requires more exacting skill, finer precision facilities or designing ingenuity than an air-borne gyro

All these forces are brought to bear in the production of every gyro in the Honeywell line

A typical example is the Honeywell hermetic integrating gyro—called HIG for short Until 1950, this type of floated gyro was an M.I.T. "dream" design—*the gyro that couldn't be mass produced*. But Honeywell proved it could. To date, 22,500 HIGs of six different types have been built

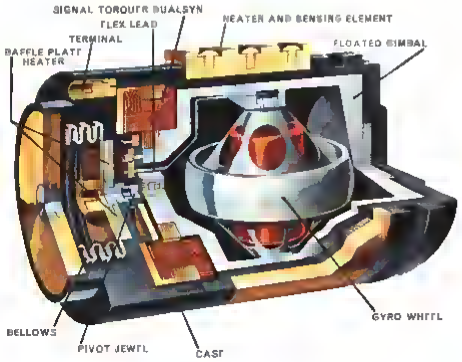
Honeywell not only proved mass production of the HIG practical, but these multi-purpose gyros have set a new standard of performance in the aeronautical field

Extremely small and lightweight, one model HIG is so super-sensitive, yet rugged, that it can measure movements 1/3000 slower than the hour hand on a wrist watch *after being used to hammer a nail*

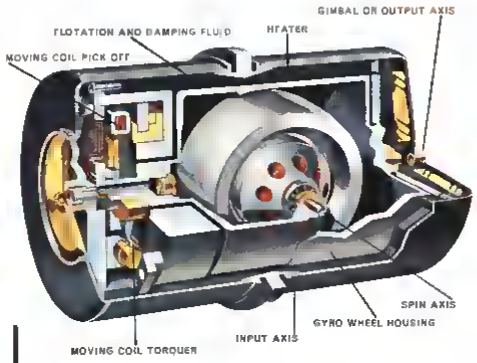
But HIGs are only part of Honeywell's air borne gyro story

Cageable gyros—20,000 of them in the last 4 years—are another fast-growing chapter, as is a wide variety of rate and standard vertical gyros for air borne service

All together, Honeywell Aero's production capacity is more than 3,000 gyros per month—a feat made possible by having the world's largest gyro production facilities.



New MIG (Miniature Integrating Gyro), GG49A—represents a scientific breakthrough in floated gyro design. Only 1.75 inches in diameter, and weighing less than 0.5 lb., its performance compares to other hermetic integrating gyros three times larger. Ounce for ounce, inch for inch, the MIG has no equal.



New Super HIG-6 Gyro, GG37—The latest and most advanced development of the famous HIG-6—designed especially for full inertial system applications. Here, too, is another scientific breakthrough in gyro design. Weighing almost a pound less than its dependable predecessor, it has even greater accuracy

FLOATED GYROS—

1. **Miniature Rate Gyro, GG18**
   A viscous damped, spring restrained rate gyro with the high precision performance, small size and ruggedness needed for missile and flight control applications.
2. **HIG-5 Gyro, GG1**
   Most popular of the fully floated integrating gyros. Designed for sensing of angular displacement, rate or both. Over 20 000 of these precision gyros in use.
3. **HIG-4 Gyro, GG14**
   Lightweight, extremely accurate floated gyro being used in the latest fire control systems. Available in several modifications including fast warm up versions
4. **HIG-6 Gyro, GG12**
   Represents a concentration on minimizing drift uncertainty. A compact package designed primarily for extreme accuracy in interim inertial guidance applications

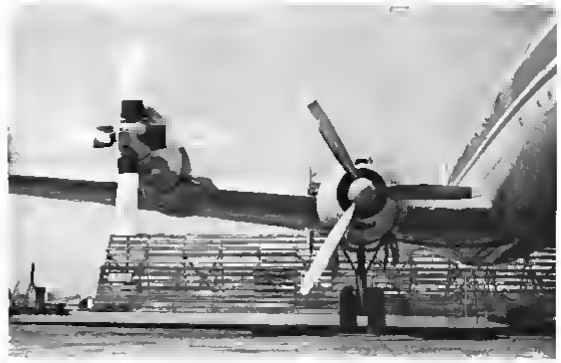
NON-FLOATED OYROS—

5. **Cageable Vertical Gyro, JG7044**
   Ideal as a vertical reference For use in radar stabilization fire control, bombing navigation and flight control systems. Uncages in 1.5 seconds—cages in 10 seconds
6. **Synchro Cageable Vertical Gyro, GG53**
   Cageable gyro adaptable to synchro or resolver pick-offs Basic use in radar stabilization. Designed for wide application demanding lightweight and accuracy
7. **Vertical Gyro, GG33**
   Specifications the same as for JG7044 except non-cageable. Ideal for vertical reference with a potentiometer pick off. Available with pigtail lead and connector

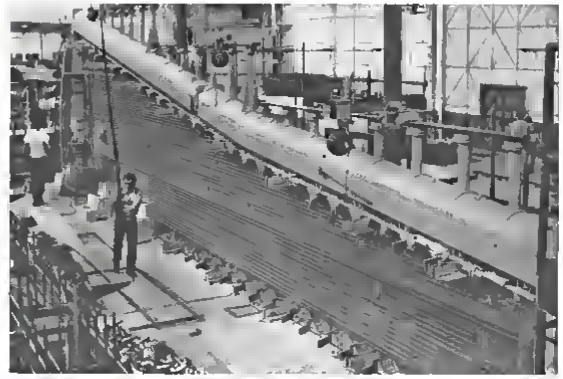
8. **Rate Gyro, JG7005**
   A general application rate gyro whose dependability and accuracy has been proved through many years of service in a multitude of different aircraft control systems
9. **Rate Gyro, GG13**
   Gives the ultimate in performance for a non-floated, damped rate gyro. Can be factory adjusted to give a damping factor up to 1.0 critical. Extremely rugged and lightweight

Lockheed tests Electra engine-propeller combination on Super Constellation.

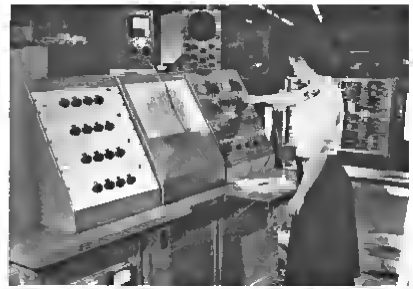
Electra Nacelle Test Flown



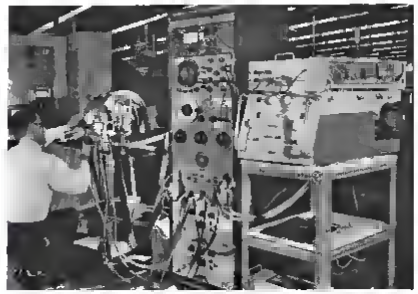
Slim nacelle for Allison 501 engine and Aeroproducts 606 propeller shows in front view.



Electra's integrally stiffened wing in jig. Wing box beams are complete and fuselage assembly has started with building of bottom quarter panels in center section.



Potentiometer checker (left) measures potentiometer resistance, function, hi-pot and noise automatically. Labor time is reduced 90%. Computer test stand (right) provides semiautomatic testing of analog computers, can solve 48 test problems involving 13 input parameters. Labor saving over 50%.



Test time is reduced 90% by automatic function tester (left). Automatic programming is scheduled at three per second for impedance or component voltage measurement, functional tests. Automatic molded unit test set (right) checks oscillators, amplifiers, modulators while circuits are energized, saves 95% test time.

Automation Cuts Armament Test Time

By Evert Clark

Baltimore—Use of automatic test machinery has cut testing time for production fire control, flight control and missile systems by 75 to 95% at Westinghouse Electric Corp.'s Air Arm Division here.

Automatic testing techniques have been applied broadly, even though Air Arm is more a job shop than a quantity production operation.

Production Quotas

Accumulated production quotas for fixed and flexible fire control systems, missile systems and special systems generally average less than 100 per month, plus spares and test equipment.

Air Arm produces the Aero 13 fire control system for Navy-Douglas F4D fighters, tail armament for the Navy-Douglas A3D attack bomber, and guidance systems for the Air Force-Boeing Bomarc interceptor missile.

Test time for these systems previously was 30% of total production time. In addition to cutting this time, use of automatic machinery has:

- **Increased production quantity.** Shortening the manufacturing cycle time permits a reduction in normal schedules and inventories.
- **Improved product quality.** Tests now can be performed which could not be done manually, and those which could be done are done more accurately. In one case, 20 units previously checked manually were put through an automatic circuit tester. Twenty per cent of them were found to contain errors that could have required extensive trouble-shooting in semi-composite or composite testing.
- **Improved labor efficiency.** High grade test personnel previously employed were difficult to find and expensive to recruit. Now scarce skilled labor is utilized in producing and servicing automatic equipment, while semi-skilled labor performs complex testing with the help of automatic machinery.
- **Reduced costs.** Two basic criteria were used in determining where automation would be used—feasibility from the mechanical point of view, and economics. At no point was automation introduced at an unrealistic cost.

Cut in Testing Times

An example of the degree to which time, labor and cost can be cut is the testing time on a fixed fire control system.

Before automation it required 1,000 hours. Now it requires 200.

R. K. McDevitt, manufacturing manager of the Air Arm Division, emphasizes the job shop nature of production.

AUTOMATIC DCR (left) measures d c resistance of transformer windings. It accomplished labor savings of 90%. Circuit checking of chassis and cable harness is performed by automatic cable harness checker (right). It reduced circuit check time by 90%.

here—four types of systems, moving along five different assembly lines, through five sets of jigs and equipment, five sets of test equipment and five sets of specially trained people. Constant engineering changes create hundreds of 'stop-and-go' situations.

Air Arm has been operating for about four and a half years. Early in its planning a Manufacturing Engineering Department and a Test Equipment Section were established. Basic design and manufacture of much of the test equipment needed for fire control systems became Air Arm's responsibility since only a part of it could be purchased outside.

Air Arm officials realized early in the operation that test hours were the area in which any attack on cost would have to be made because they comprised almost one third of the total production time.

An automation committee, composed of both test and manufacturing engineers, was created to study feasibility and economics. It found two types of test operations in which responsibility for decisions, judgment and mechanical skills could be transferred from operator to machine at a justifiable cost:

- **High volume repetitive testing** with small variations of parameters, such as transformer testing.
- **Low volume repetitive sequential testing** demanding large variations of parameters, such as computer testing.

Basic Operational Areas

Test operations throughout the plant were broken down into basic operational areas, and the automation committee picked these five where members thought progress could be obtained through use of automatic machinery:

- **Component testing** at the incoming inspection and at transformer manufacturing.
- **Wiring-harness checkout** at the assembly stages.
- **Unit and subassembly testing.**
- **Composite testing.**

Engineers who attacked the test problems under the direction of H. A. Leone soon found themselves in the field of automatic test equipment design—either because no equipment existed or because cost of available equipment was too high.

Now, however, equipment has been modified or developed to the point that automatic testing has been applied across a wide range of test problems.

Machines in Use

Machines now in use or in advanced development include:

- **Automatic molded unit test set** for rapid, accurate static and dynamic testing of small molded electronic circuits containing tubes, resistors, capacitors and transformers. Reduction in test time has been 95%. One hundred types of subassemblies, ranging from simple resistive networks to complicated inverters and demodulators can be tested. Change in the setting for different types of units can be made in 10 sec. by means of prewired patchboards. This set was designed, developed and manufactured here.
- **Automatic turns-ratio test set** for measuring the ratio of turns between primary and secondary in airborne transformers. Labor reduction is 90%. One loading accommodates 24 transformers with up to five windings each. Indicator lamps show not only which transformer fails but which winding. Only change necessary to test different types of transformers is a change of punched cards that control the automatic turns-ratio bridge. This also was designed and developed here.
- **Automatic DCR** test set for testing d c resistance of transformer windings. Automation was adapted because of a high-volume, one-type test operation. The system uses a d.c. resistance bridge and a card-controlled programmer with a digital read out as the turns-ratio tester does. Indicator shows all results as good or bad. This was designed and developed here.
- **Automatic computer test stand** for testing airborne fire control computers. This executes an over-all performance check by presenting 432 bits of problem information which the computer must solve to a high degree of accuracy. Checking includes a complete series of 48 test problems involving 13 input parameters. Speed of operation has increased by eight to one in composite test and two to one in alignment. Labor saving is over 50%. This also was designed and developed here.
- **Automatic cable harness checker,** a continuity, short circuit and leakage tester capable of making up to six checks a second. The unit amplifies the location of the trouble. The basic device can test 200 circuits for continuity, short and leakage simultaneously, and, by the use of adapters, the number of tests can be increased to 400, 800 and 1,200. The machine can test multiple circuits with as many as 56 common circuits. Circuit test time has been reduced by 90%. The basic machine was purchased elsewhere and further developed here.
- **Automatic function tester.** This machine makes continuity, leakage, resistance, impedance, a c and d c voltage measurements at a rate of three tests per second. An adapter which plugs into the top of the supertester allows 400 tests. Test time has been reduced 90%.
- **Automatic potentiometer tester.** Although a component testing device, it represents the initial phase of Air Arm Division's most complex attempt at automation. Components tested are gang-operated precision potentiometers used in fire control system computers. Although very few potentiometers are built to the same exact specifications, each must be extremely accurate and—in a gang-operated pot—each potentiometer must be accurately aligned with the rest. The machine is controlled by punched cards which set up the individual test, indicate accuracy limits desired, and control the machine to make the test.

Potentiometers are tested for resistance, linearity of conformity, dielectric strength and electrical noise. Labor time reduction is 90%. This machine was designed and is being developed here.

Military Interest

The military services, particularly Navy, have shown a great deal of interest in these machines and testing techniques, Air Arm officials say. Other Westinghouse divisions also have indicated a strong interest. Division officials see a broad potential for application of

Germans Order Sycamores

First of 50 Bristol Sycamore helicopters ordered by the West German Ministry of Defense is test flown from the Weston Division of Bristol Aircraft Ltd., where Sycamore production is concentrated. Sycamore is flying over sand beach with water in background.

these techniques, even in job-shop operations

Dr S W Herwald, division manager said there still is much to be done, particularly with regard to using punched programming techniques applied to test and manufacturing equipment, so that relatively standard equipment such as drills milling machines and punch presses, can be made to perform in small job lot quantities in almost as efficient a manner as if we had high mass production quantities to which we could fully tool"

The ultimate goal, Herwald says, is when we can take a bill of material of any random device to be built, punch cards related to this bill such as basic chassis dimensions, hole locations, etc and connect up with a complete manufacture and test of this unique piece of apparatus with a minimum number of man-hours

", It will require diligent work over the next 5 to 10 years to reach an appreciable percentage of that goal

Kel-F Process Sold By Kellogg Firm

Jersey City, N. J.—Minnesota Mining & Manufacturing Co purchased the Kel-F polymer manufacturing business from M W Kellogg Co Kel-F, a corrosion resistant resin, has been tried in manufacture of some components for guided missiles and aircraft

Main problem with Kel-F has been inability to resist temperatures over 400F Otherwise, versatile polymer can be manufactured in substance resembling oil, wax, rubber or plastic

Minnesota Mining said its primary interest in purchasing Kel-F business is to develop additional uses, particularly within chemical field and for pharmaceutical packaging

Kel-F manufacturing unit, now adjacent to Kellogg plant in Jersey City, will not be moved to Minnesota Purchase was made through a stock exchange; no cash was involved

Army Contracts for Instrument Training

Washington—Four commercial flying school operators have received U S Army contracts to provide instrument flight training to 440 rated aviators Average cost will be $2,750 per student

The contracts were given by five of the Continental armies, and the training will be conducted at five airfields

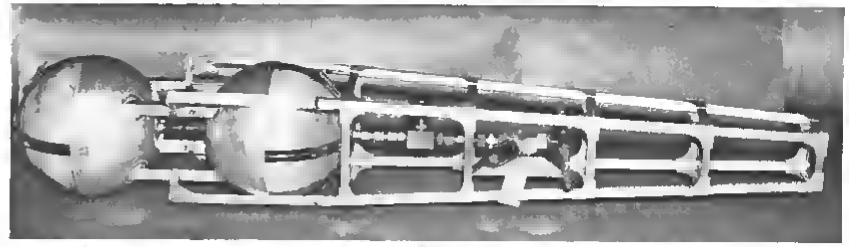
- Hinson Aviation Co, Harbor Field Baltimore, Md, three classes to train 70 aviators of the First and Second Armies
- Central American Airways Flying Service Inc., Bowman Field, Louisville Ky will train 200 aviators There will be five classes each at Outlaw Field, Clarksville Tenn, and Freeman Field Seymour Ind Contract is with the Third and Fifth Armies
- Spartan School of Aeronautics, Tulsa, Okla., will train 70 aviators in four classes at Ft Sill, Okla., for the Fourth Army
- Trans-Ocean Airlines, Oakland, Calif, will train about 100 aviators in six classes at Oakland International Airport for the Sixth Army

The training, Army spokesmen said, will parallel the instrument course given at the Army Aviation School at Ft. Rucker, Ala There will be 80 hours of flight instruction and 180 hours of ground school in the eight week course.

Two Contracts Awarded for Sidewinder Guidance

Naval Ordnance Test Station at Invokern, Calif, awarded two new contracts to Avion Division of ACF Industries, Inc, for Sidewinder guidance and control system Contracts are fifth and sixth to Avion for same system

General Electric announced first test firing of a Sidewinder controlled by its guidance unit was a success, scoring a direct hit



TWO 12-IN. filament wound pressure spheres in Aerobee sounding rocket hold gas at pressure of 3,000 psi

Plastics Stand Heat, Grow in Missile Use

By Irving Stone

Los Angeles—Growing application of reinforced plastics for high temperature service in the missile and rocket industry was described here at the annual conference of the Society of The Plastics Industry.

Details of this material usage were outlined by four members of Aerojet General Corp's Structural Plastic Department George Epstein, James W Eberhardt, Jack Goldberg and Harry V King

Epstein, who presented the paper, pointed out that solid and liquid-propellant rockets in which reinforced plastics are now being used and those for which the materials are being developed include missile boosters and prime powerplants, assisted takeoff units, in flight thrust augmentation equipment for piloted aircraft, auxiliary power units and gas generators, and underwater propulsion devices Reinforced plastics are also being used in explosive-ordnance, warhead and armament devices

Reasons advanced for using reinforced plastics in various missile and rocket motor applications

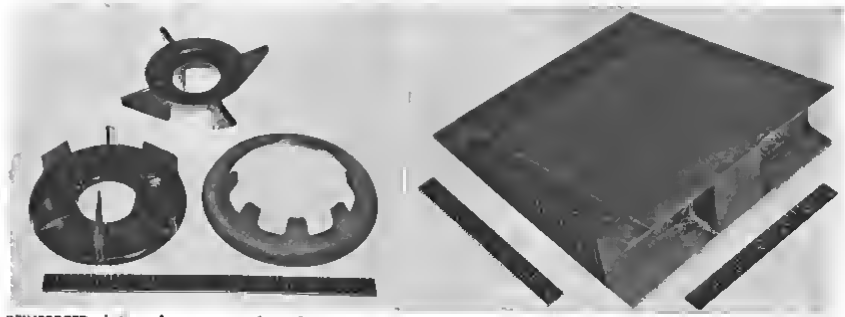
- High strength-to-weight ratio
- Good thermal insulating properties

Polyester and epoxy resins usually are used at temperatures between —65 and 200F Heat resistant epoxy, phenolic, triallylcyanurate-modified polyester and silicone resins are used for intermediate—200-500F—and high—500 to 1,000F—temperature ranges, with silicones usually limited to long duration or repeated exposures Reinforced plastics also are used when exposure is required for extremely short duration to temperatures of several thousand degrees Fahrenheit Gas erosion resistance is frequently a desirable characteristic

- Ability to fabricate complex configurations relatively inexpensively This is considered especially important during development phases and for limited production Fabrication techniques include layup, matched die molding, filament winding, casting and adhesive bonding
- Wide versatility in selection and formulation of resin-curative-filler (reinforcement) systems Glass reinforcements, in the form of fabric and rovings, are used primarily with polyester, epoxy, elevated-temperature resistant phenolic and silicone resins Asbestos reinforcements, refractory powders, and other filler materials are used to a lesser extent Curing agents are selected on the basis of specific service requirements
- Material is non-critical, and possesses resistance to many environments

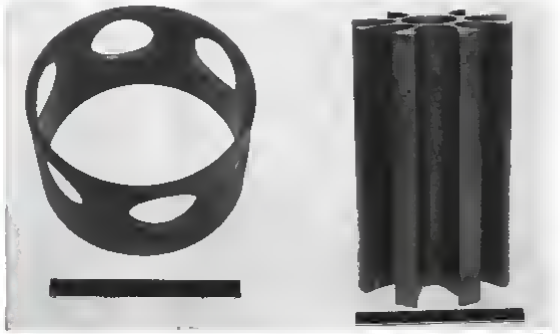
Applications of reinforced plastics mentioned by Epstein included

- Guided missile warheads developed by Aerojet These have made extensive use of glass-reinforced-plastic structures



REINFORCED plastic end supports are for rocket motor solid propellant Units are molded (top and left), or machined (right).

HONEYCOMB reinforced plastic section of fin assembly is under development for advanced Aerobee sounding rocket application



REINFORCED plastic liner for rocket motor insulates against 3,000F temperatures.

PLASTIC tooling for rocket motor embodies cast outer body, filament-wound inner tube

because of minimum parasitic weight, increased strength to weight ratio. These also provide versatility in design. Warheads using reinforced plastic structures and adhesive-bonded metal components have successfully withstood the most severe military environmental tests, Epstein said. In many cases, warheads subjected to these tests have been completely usable when their metal counterparts would have been rendered useless, he added.

Chemical Compatibility

Other ordnance applications utilizing structural plastics include mines and fuse components. In ordnance items where the plastic comes in contact with the explosive, there must be complete chemical compatibility of the resin and explosive.

- **Fairing strip** used for thermal insulation in an operational missile. This section was fabricated by vacuum bag molding of heat-resistant phenolic-resin impregnated glass fabric laminate.
- **Insulator** to protect metal from heat of burning solid propellant in rocket motor. This unit was subjected to several thousand degrees Fahrenheit for about one second, also was fabricated by vacuum bag molding of phenolic resin-impregnated glass fabric.
- **Insert** to protect metal nozzle entrances from heat or exhaust. This installation was used in two air-to-air rocket motors.
- **Liner** for insulating nozzle adapter in rocket motor during operation of a safety device. Service conditions required exposure to more than 3,000F for several seconds in high velocity gas stream. Aerojet developed the modified epoxy resin formulation, XSP-1, for this unit, and low-pressure laminating techniques were used.
- **Tee baffle** for JATO unit. This part is subjected to gas temperature of about 3,800F and gas velocities of several hundred feet per second for duration of approximately 15 sec. In addition to providing a thermal barrier, this phenolic-resin glass-fabric-reinforced part suppresses instability which might occur during combustion of the solid propellant.
- **End supports** for rocket motor solid-propellant charges of complex configurations. These supports have been made from phenolic and melamine resins reinforced with chopped glass fabric, chopped glass roving and cotton fabric. Fabricating techniques include machining from stock and matched die molding.
- **Honeycomb plastic sandwich** fin assembly under development for advanced Acrobee sounding rocket. Skin and end closure channel are made from high-temperature phenolic glass laminate, core is phenolic glass honeycomb. High temperature modified epoxy phenolic adhesive is used as bonding agent. Leading edge skin portion has herringbone pattern for maximum erosion resistance during high speed flight.

REINFORCED plastic shroud assembly for protection of delicate ordnance device components fabricated by matched-die molding

Shroud for housing delicate components in an ordnance device. This unit, fabricated by matched-die molding, also contains a silicone resin impregnated glass-fabric cone mounted in the shroud aperture to protect against localized high temperatures.

Tooling for rocket motor part. Outer portion was made by casting a filled epoxy resin. Inner portion is a filament wound glass laminate tube providing rigidity.

- **Spherical, tubular** and special shape components using wound glass filament makeup. Included in this category are igniter baskets, produced in various sizes, for containing pyrotechnic pellets for initiation of rocket firings, and operating for short duration at temperatures of 6,000-7,000F.

Other Uses

Other filament-wound units include pressure spheres varying in diameter from 1½ to 21 in. and in design burst pressure from less than 100 to more than 10,000 psi.

In addition to use in aircraft hydraulic systems, these spheres are used in missiles and rockets to pressurize liquid propellants and as high pressure containers in general.

One experimental oval shaped container has built-in internal stiffeners to provide rigidity against external pressure.

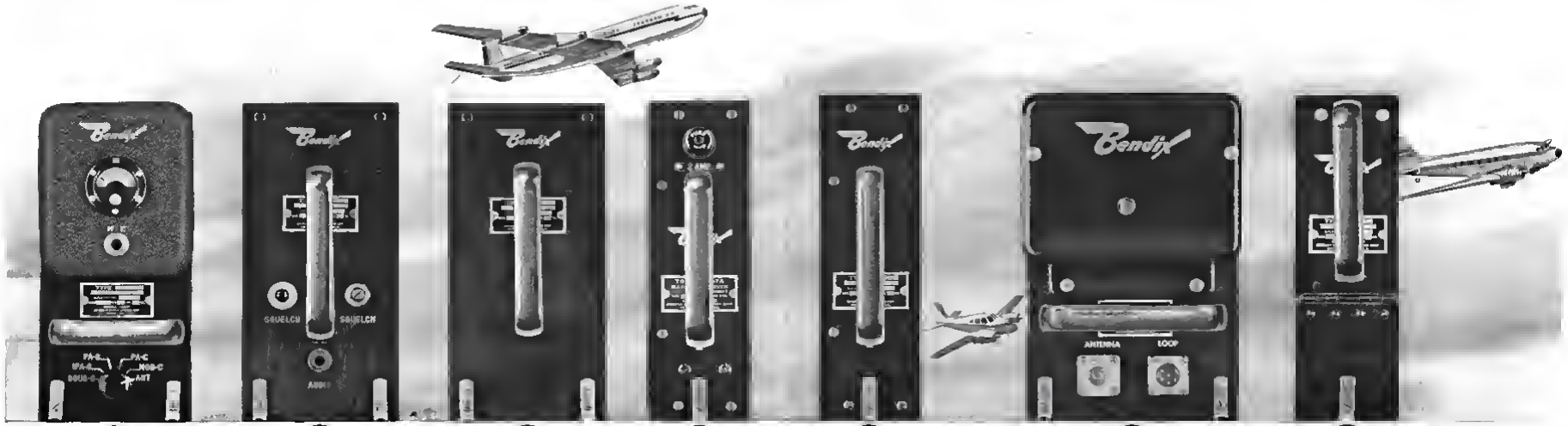
Filament winding provides means for obtaining maximum strength to weight ratio by locating each glass filament at its optimum position.

If the part is to be stressed in one direction only, all or nearly all of the filaments can be applied to counteract this force.

Temco Earnings Show Research Increase

Temco Aircraft Corp. increased R&D activity was felt last year in Temco's earnings. Net income after taxes was $2,257,241, compared with $3,103,070 in 1955. R&D expenditures increased from $876,719 in 1955 to $2,981,517 last year. This increased expense was the primary factor behind the reduction in earnings.

Temco's total sales were $90,317,249 in 1956, an increase from the 1955 level of $78,224,390. Backlog was $96 million at the end of 1955 and $180 million at the end of last year. Prime contracts accounted for less than 1% of the 1956 backlog and 11% of the 1956 total.



1 **TA-21A VHF TRANSMITTER**—Complete unit for RA-21A VHF Receiver. Reliability increased by new, improved circuitry, use of printed wiring and transistorized power supply. Power requirements reduced. Short ⅝ ATR. 360 channels, 50 KC spacing. Complete unit remote controlled. 25 watts output.

2 **RA-21A VHF RECEIVER**—Designed as companion unit for TA-21A VHF Transmitter to provide complete VHF communications. When used with the NVA-21A Navigation Unit, it provides complete VOR/LOC reception. Short ⅝ ATR; 360 channels, 50 KC spacing. Transistorized power supply, printed wiring, remote control.

3 **NVA-21A NAVIGATION UNIT**—For use with RA-21A VHF Receiver to provide complete VOR/LOC course information. Completely transistorized. Incorporates in single package all required audio and intermediate circuits for complete automatic VOR/LOC instrumentation. Short ⅝ ATR. Facilities provided for (a) Tone Localizer, (b) Manual Omni Range, (c) Automatic Omni Range.

4 **MKA-7A MARKER RECEIVER**—½ ATR single-channel one-piece receiver for reception of beacon signals from airway fan markers. Utilizes latest Z markers and ILS approach markers. Increased circuitry eliminates many possible erroneous signal lamp indications due to TV and FM interference.

5 **GSA-8A GLIDE SLOPE RECEIVER**—20 channel UHF Receiver. When combined with NVA-21A VOR Navigation Unit, provides complete ILS receiving facilities. New audio circuits assure higher degree of course stability and more reliable flag alarm information. Entire unit, including either AC or DC (transistorized) power supply, is housed in short ½ ATR case.

6 **DFA-70 AUTOMATIC DIRECTION FINDER**—½ ATR. Covers all frequencies from 90 to 1750 KC. Provides both visual and aural navigation information, including narrow band aural reception. Electrical tuning eliminates lash shafts, permits control panel to be located as far as 50 feet from receiver. Increased operating range, higher sensitivity, greater accuracy.

7 **AMA-70A PASSENGER ADDRESS AMPLIFIER**—Complete transistorization and modular construction. Three input circuits are provided: carbon microphone, dynamic microphone and tape recorder. Maximum of 5 individually controlled plug-in type amplifier modules permit composition for different noise levels in passenger compartment for customized performance during flight and on-ground operation. Short ½ ATR.

NEW LIGHTWEIGHT NAV/COM SYSTEMS

New Bendix Equipment Meets Requirements of Latest Jet and Turbo-Prop Airliners and Virtually All Business-Type Aircraft.*

The geowing complexity of jet-age aircraft, together with ever-increasing demands for improved performance and lower operating costs have introduced a number of perplexing problems for designers of airborne communications and navigation systems. Available space and permissible weight allowances have shrunk. Needs for improved performance, reliability and dependability have increased. A growing fleet of business-type aircraft, plus increased traffic problems have created a pressing need for communications and navigation equipment of true airline quality for *all* types of commercial aircraft. Not only the commercial transports, but the business types as well.

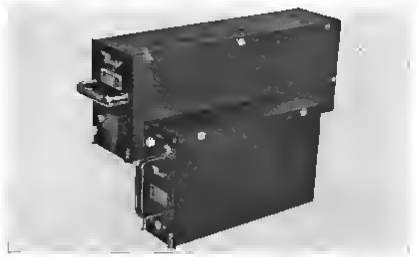
Bendix' new lightweight navigation and communications systems fill these exacting requirements. Units are lighter and smaller. Designed to fit neatly and compactly into the biggest transport or the smallest executive-type twin. Complete packages, if desired, to meet your particular requirements. Yet flexible. For the most part these new units are interchangeable and can be integrated with the time-tested and dependable Bendix systems now in use in a wide variety of aircraft all over the world.

Examine some of the new communications and navigation aids described on these pages. See how improved design, improved circuitry and transistorization plus improved packaging are combined to give you lighter and more compact installations—with improved performance and reliability. For further information and complete specifications write to Bendix Radio Division, Aviation Electronic Products, Baltimore 4, Maryland. Or West Coast—10500 Magnolia Blvd., N. Hollywood, Calif.; Export—Bendix International Division, 205 East 42nd Street, New York 17, N. Y.; Canada—Computing Devices of Canada Limited, P.O. Box 508, Ottawa, Ontario.

*REG. U.S. PAT. OFF.

ATTENTION ENGINEERS Our expanding commercial aviation programs in airborne navigation communications and radar have created a need for qualified electronics engineers, particularly those having five to eight years' experience. We invite your inquiry.

FOR AIRLINE AND BUSINESS AIRCRAFT



Scope of size and weight reductions in new Bendix NAV/COM Systems is illustrated above. Upper left is standard ½ ATR unit; lower right, new compact, lightweight, short ⅜ ATR unit.

Bendix Radio Division

Bendix AVIATION CORPORATION

Sub-System Makers Face Missile Hurdle

By Claude Witze

Wright-Patterson AFB, Ohio—Aeronautical component and sub-system manufacturers are being urged by USAF's Air Materiel Command to adjust their development efforts and production potential to meet the challenge of guided missiles.

They have been warned, in effect that, continuation of AMC's policy of buying Government Furnished Aeronautical Equipment (GFAE) will depend to a large degree upon their performance in the missile field.

Selling Themselves

The specialty manufacturers are faced with the necessity of selling themselves to USAF prime contractors by their ability to help integrate a complete weapon system while it is under development.

Maj Gen David H Baker, AMC director of procurement and production, says the shift from conventional aircraft to guided missiles has generated a large number of common requirements for such things as powerplants, electronic sub-systems, fuel systems and controls.

Procedure Shift

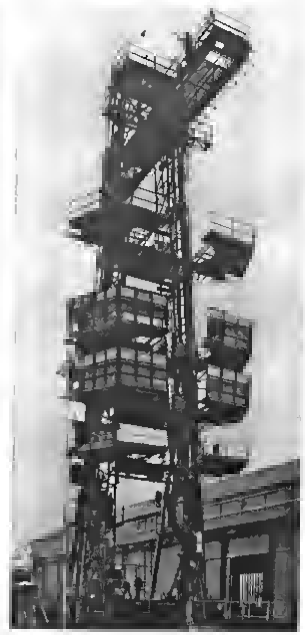
In a speech at a Society of Automotive Engineers meeting, the General acknowledged that, in many cases, much or all of this work is being performed by the prime contractors. This represents a shift from the system created by AMC for weapon systems based upon ordinary airplane vehicles.

The reason for the change, Gen Baker said, is found, at least in part, in the failure of specialized sub system and component manufacturers to show an aggressive interest in missile production problems. He fears that, if the trend continues, there will be a growing requirement for new production and testing facilities.

Other possibilities that concern Gen Baker:

- **Duplication of engineering** capabilities by prime contractors while they are available in plants of the sub-system makers.
- **Further concentration** of industry, with serious economic and military implications.
- **USAF** may be forced to abandon its goal of having 40% of the prime dollar value passed on to airframe subcontractors. This is because, in missile procurement, volume is low, and existing prime facilities are only partly utilized.

Gen Baker indicated that the Air Force is taking a hard look at these problems and that fundamental policy



Missile Test Stand for Patrick

Missile test stand, which tilts for stowage during hurricane season, was built for Army Ballistic Missile Agency by Noble Co., Oakland, Calif. Self contained motors tilt stand, which is 120 ft high, weighs 340,000 lb. and moves under own power on two sets of standard gage railroad tracks. Five elevator platforms are spaced vertically. Control room is in base. Tower will be installed at Patrick AFB, Fla.

Emphasis on Reliability

There will be no letup in USAF's ever-growing emphasis upon reliability.

"Perfectionism," says Maj. Gen. David H. Baker, Air Materiel Command's director of procurement and production, "is mandatory if we are to protect the nation." Gen. Baker explains the necessity in terms of fighter-intercept missions:

To put the fighter into the air at the proper time calls into play the functioning of an extensive radar net capable of determining altitude, speed, direction and numbers of attacking aircraft. This intelligence must be instantaneously and continuously transmitted to a combat control center and correlated, through electronic computers, with similar intelligence from other sectors of the net.

"The scramble order to the fighter squadron must be automatically transmitted giving time, direction and course setting. Within the airplane, when airborne, automatic pilot and flight controls take over, which must continue to receive correctional inputs based on later radar observations from the control center.

"These automatic control and navigation systems, through the use of airborne computers, must integrate, correlate and feed back data on air speed, altitude, ground speed, magnetic and radio compass readings, altitude of the plane and distance traveled or time.

"Flying at speeds from 1,000 to 2,000 miles an hour, on a course calculated to intercept the attacker . . . at ranges up to 1,000 miles, the slightest error or angular deflection in course will lead to a mission abort.

"Nor is this all. The fighter must carry its own radar search which comes into play when approaching the zone of intercept. This system must take over the flight control and navigation job.

"At the pilot's command the radar must lock on to the target and assume direction of the fire control system for delivery of the kill projectiles. All of this must happen [illegible] second guessing or equipment failure if we are to kill the target.

". . . Failure to intercept or destroy now has lethal penalties attached of unimaginable orders of magnitude.

"Literally, whole cities and their environs making up our national potential for survival are vulnerable."

changes, or modifications probably will be imposed as more and more of the procurement dollars go into missiles.

Tighter Control

"The Air Force," Gen. Baker declared, 'must reconsider its policies for complete systems integration during development and production of missiles and provide a means for closer control, particularly during the development portion of a program, to insure that specialized industry functions are not duplicated in our prime plants when they are fully available within the existing aeronautical industry." He continued:

"In the area of production we must examine closely the desirability of moving to GFAE method of procurement in more areas than the very few which we currently have.

"While I do not expect the degree of GFAE will equal that which we currently have on aircraft, on the other hand, it would appear that the present policy is not suitable. . . ."

Most Affected

Gen. Baker said the sub-system and component manufacturers will be those primarily affected by AMC's effort to solve its major problems in the next few years.

He said this segment of the industry "must recognize that there is a need, more than ever before, for a systems contractor and even a sub-systems contractor to integrate the complete weapon system, particularly in the development stage.

"This is a big job which the Air Force cannot undertake itself," he said.

Long Life Prototype Atom Battery Shown

Nuclear batteries are available in prototype which will give continual power over long durations. Walter Kidde Nuclear Laboratories, Garden City, N. Y., reports its nuclear battery, which was developed for the Elgin Watch Co., will retain half power up to 2.6 years. Power output is poor now because it only operates at 1% efficiency.

A dime-sized prototype battery displayed by Kidde at the recent Atomic Exposition, Philadelphia, Pa., delivered 20 microwatts. Inside the tiny battery energy emitted from a wafer of radioactive promethium 147 was converted into electrical output in two steps: radiation was first converted into light by a cadmium sulphide crystalline phosphor, then the light energy was transformed into electrical energy by means of a silicone diffused junction photocell, made by the Semicon

ductor division, Hoffman Electronics Corp.

Because the energy source is a decaying radioactive isotope, the power output of the nuclear battery dies exponentially. After 2.6 years, the half-life of the Pm 147 isotope, the current is only ½ of its original value although the voltage is said to remain constant.

Operating characteristics of nuclear batteries are something like a long duration version of the common hand wound watch spring which Elgin originally conceived the battery as replacing. However, the nuclear battery, because it works on radiation, is continually dissipating its energy regardless of whether that energy is being put to work or not.

Dr. Arthur Bradley, one of the developers at Kidde, suggests that the battery could best be used in applications where a modest amount of power is needed continuously over a two to five year period. It could be used as the power source of miniature self-operating remote-area weather stations, which could be dropped on polar ice caps, set adrift on the oceans, or in long life space satellites. Unlike solar batteries, it would be able to operate in shadow.

The nuclear battery can operate at temperatures from −200F to over +212F. Since Pm 147 emits only Beta particles of rather low energy, shielding is relatively simple.

The price is difficult to predict. Critical ingredient, Pm 147, costs $500 per curie and four curies are used. Thus the batteries must each cost over $2,000. Kidde expects Pm 147 to be produced in quantity as a by-product of the government's new cesium 137 gamma isotope processing plants. This could lower the price of Pm 147 to $1-$5 per curie.

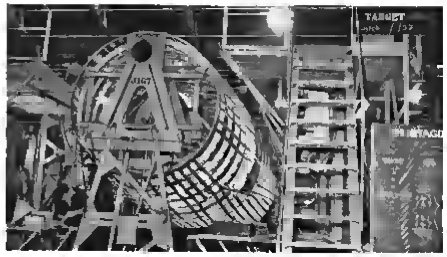
Aerojet Reactor Starts Energy Production

San Ramon, Calif.—Aerojet General Nucleonics' third AGN 201 training and research reactor has gone critical.

The company's first reactor went critical on Oct. 25 with 656 grams of U-235 of 20% enrichment and the second on Feb. 25 with 657 grams of U-235 of 20% enrichment. The recent system (Serial 102) required 654 grams of U-235 of 20% enrichment.

The reactor ANG 201 is the first in the world to be mass produced and the first and only one in operation judged safe enough by the Atomic Energy Commission to allow operation in existing buildings in heavily populated areas, the company said. It has scheduled one AGN 201 system to come off the assembly line every two weeks.

Two Plants Share Viscount Assembly



Viscount number 757 for Trans Canada Air Lines moves down final assembly line at Vickers Armstrongs' Hurn factory near Bournemouth (top). Twelve Viscount 800 series also are being assembled for British European Airways (bottom). First of 15 modified 800 series for Continental Airlines in subassembly at the main Vickers Armstrongs plant at Weybridge (center). Sub assemblies from Weybridge are sent to Hurn where they are built into fuselages in fuselage shop (bottom), then assembled completely in one of two 12-plane "erecting shops" (top).

MICRO SWITCH Precision

...FIRST IN PRECISION SWITCHING

Over 200 MICRO SWITCH Precision Switches help make Lockheed's C-130 Hercules a superb military transport plane

MICRO SWITCH Precision Switches are located at over 200 strategic points to facilitate the fine operation of the Lockheed C-130 Hercules, the first propjet transport accepted by the U. S. Air Force

During five years of planning, designing and manufacturing, MICRO SWITCH engineering service has cooperated with Lockheed engineers of the Georgia Division at Marietta, Ga., in the choice of exactly the right switches to perform important functions—and to keep on performing them, time after time, day after day, anywhere in the world.

MICRO SWITCH Precision Switches also perform important functions in components supplied for this plane by other manufacturers. Even more—they provide important controls for machine tools used in the building of the C-130 itself.

Here indeed is a tribute to a new first in Aviation—the Lockheed Hercules—to MICRO SWITCH's leadership in the precision switch field and to the loyal and intelligent service rendered Lockheed by MICRO SWITCH Field Application Engineers.

Wide variety of switch types in the Hercules

Series VA enclosed Switches. These combine the features of sealed construction and high electrical capacity. They are available with roller arm or lever actuators

Series V3 Basic Switches. These have the highest electrical capacity for their size of any switch available. Are available in wide variety of terminal designs, contact arrangements and operating characteristics.

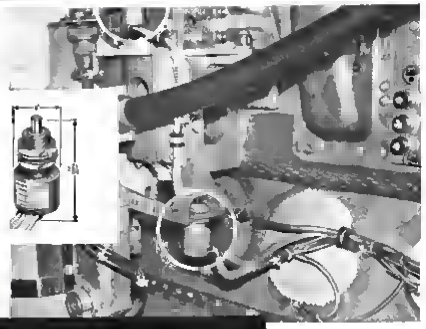
Series SE Sealed Subminiature Switches. These are the smallest and lightest completely environment-free precision switches available. They are built to give trouble-free operation in a temperature range of from −65°F to +212°F

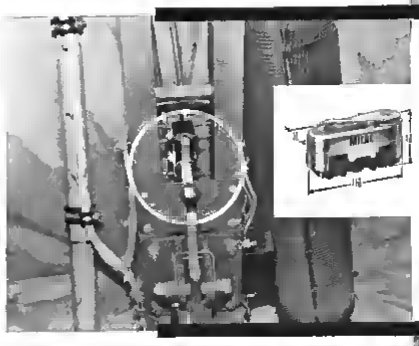
Series DT Double-Pole Double-Throw Switches. These switches simultaneously make and break two independent circuits. The double-throw contact arrangement provides a normally open and a normally-closed contact for each pole

Switches have uses unlimited

Switches for landing gear locks

Photograph shows two MICRO SWITCH Type EN switches as applied to the up and down lock of the Hercules' landing gear. There are 22 of these EN Type switches used in this plane. These switches are completely sealed against the effects of changes in atmospheric conditions. The precision switching units are housed in a sealed enclosure, assuring constant operating characteristics of the switching element.



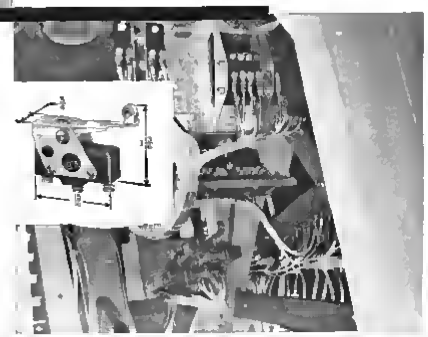


Switches for ramp door lock indicator

Photograph shows MICRO SWITCH Type HS switch which is used to indicate an unlocked position of the ramp door. This is a hermetically-sealed switch which insures constant operating characteristics regardless of changes in atmospheric conditions. It is used with a long plunger actuator for penal mounting.

Switches for power quadrant

Photograph shows a bank of MICRO SWITCH switches with roller actuators used in the pedestal or power quadrant. These control the prop synchronization and the sequencing control of engine and prop. The basic switches are double pole double-throw. The roller actuator shown is one of many MICRO SWITCH actuator types which provide basic switches with easy means of installation and adjustment and adapt them to the specific operating means.



Two new MICRO SWITCH catalogs—No. 77 and No. 76—on switches for aircraft are just out. Do you have your copy?

MICRO SWITCH

A DIVISION OF MINNEAPOLIS HONEYWELL REGULATOR COMPANY

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Data Link May Start Vortac-Type Battle

By Philip J. Klass

New York—Recent unveiling of the Tacan-Vortac data link, in an obvious bid for its Common System use, should produce long needed action to formulate airspace user operational requirements for such equipment. This in turn could precipitate another Vortac-type battle between competing techniques and equipment.

Declassification of Tacan data link details (AW Mar. 18, p. 31) reveals both the ingenuity of the original Tacan design concept, long obscured by military security, and the fact that it follows closely the "Ultimate Common System" concept set forth in 1948 by the Radio Technical Commission for Aeronautics SC-31 blueprint.

Full Details

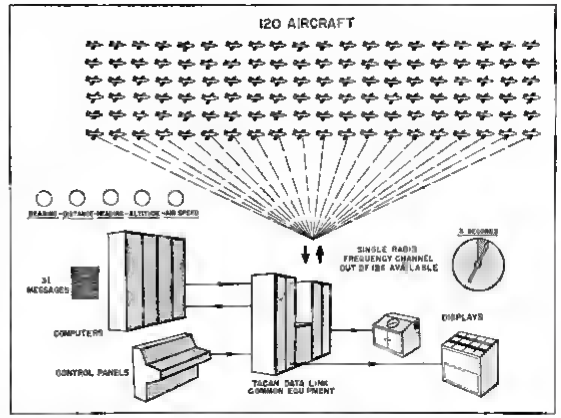
Tacan is now revealed to be a single integrated system capable of providing a variety of navigation and communication functions, including:

- Bearing and distance navigation information.
- Automatic air-to-ground reporting of aircraft position, speed, altitude and heading.
- Speedy push button two-way communication for routine messages between pilot and ground controller.
- Automatic control of aircraft position, speed, altitude and heading from the ground, either by human controller or by automatic intercept, traffic control or landing computers. (This function is intended for military use and probably would not be included in a Common System civil version.)
- Instrument approach capability, comparable to ILS, permitting both manual and automatic instrument approaches.

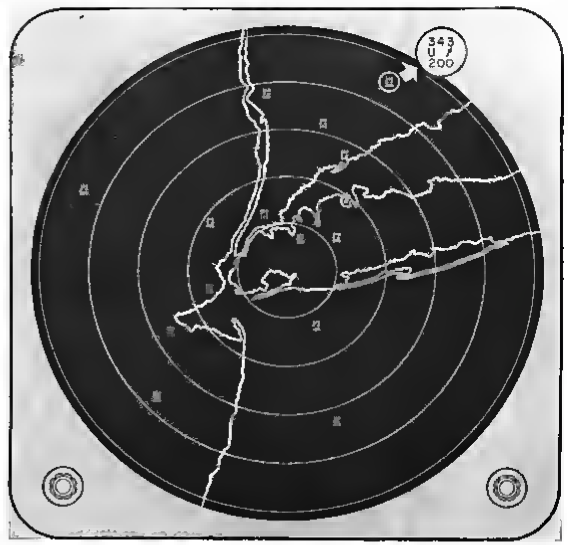
These added capabilities are at least a partial answer to critics who, during the recent Vortac controversy, accused Tacan of being wasteful of radio spectrum considering the limited service it was then officially acknowledged to provide. AVIATION WEEK had disclosed the existence of Tacan's data link as early as 1955, but details were under classification.)

The data link, like Tacan itself, was developed by Federal Telecommunication Laboratories under Navy sponsorship.

By adding data link adaptors to airborne and ground based Tacan or Vortac equipment, it should be possible to greatly relieve over-congested voice communication channels and ease pilot-con-



NEW TACAN DATA LINK enables 120 aircraft to report automatically their altitude, air speed, heading, bearing and distance (from Vortac station) in less than three seconds as well as providing two-way push button communication of routine messages. On the ground, aircraft position report could be displayed on Charactron tube (below) in code that shows airplane altitude, airspeed, heading and identity as well as position.



roller chores. The ground controller could then obtain fresh position-altitude-speed reports on each of 120 aircraft every three seconds. Information that would take at least an hour to obtain by voice radio. Transmission of each two-way message requires less than six thousandths of a second. Equally important, the aircraft reports are obtained without any effort on the part of the pilot.

The airborne data link gets its bearing-distance information automatically from the Tacan receiver and obtains altitude, airspeed and heading from pick-offs mounted on the cockpit instruments. Data link messages are received and transmitted using existing Tacan/Vortac receivers and transmitters with only slight modification.

Position reports could be displayed on a Charactron type of radar scope with a coded array that gives aircraft identity, speed, altitude and heading as well as showing its position. (See sketch, p. 85.)

The aircraft position information which Tacan data link provides duplicates that available from radar, but the system also provides airplane altitude, heading and airspeed information which is not currently available from civil radars.

Current plans call for obtaining automatic altitude reporting from the new air traffic control radar transponders, providing sufficient codes can be made available for this purpose.

Routine Messages

The ground controller will have a choice of 31 different routine messages, such as "descend 1,000 feet," or "call in by voice radio," which he can transmit merely by selecting the proper button on a console and "addressing" the message to the desired airplane using its registration number or other identity code. Within three seconds the message will appear in visual form on a panel indicator in the cockpit of the airplane to which it was addressed.

The pilot also would have a choice of 31 different frequently used messages which he can transmit to the controller by selecting the proper push-button. (See photo, p. 96.) No address is necessary since it automatically goes to the Vortac station to which pilot is tuned. After suitable automatic processing on the ground the report can be remoted by ordinary telephone lines to the Air Route Traffic Control Center, FTL says.

This should prove a real boon to international carriers. Aircraft messages can be shown in the pilot's native tongue in the cockpit but displayed in the controller's native tongue on the ground.

Perhaps the greatest pay off for data link will come with the advent of automatic traffic control computers designed to monitor traffic and automatically to spot potential conflicts or collisions. With data link, the computer could automatically transmit an emergency message to the aircraft in question without human intervention or delay of waiting for a controller to send the message by voice radio.

Direct to Computer

Similarly, when a pilot sends a data link request for a change of altitude this message could go directly into the computer without delay. The computer could instantly search its memory for possible conflicts, then automatically transmit back its approval or denial in a matter of seconds.

Briefly stated, the Tacan data link operates somewhat like the distance measuring equipment (DME) portion of Tacan or Vortac, but in the reverse direction.

To obtain DME information, the airborne transmitter sends out a pair of pulses which travel to the ground Vortac station where they trigger its transmitter to reply with a similar pair of pulses. These travel back to the aircraft's receiver which measures the total transit time from which it determines distance between airplane and ground station.

For data link operation, the ground station imitates the proceedings by transmitting a brief pulse coded message to the airborne receiver. When received by the aircraft to which it is addressed, the ground message is displayed on cockpit instruments and the airborne unit responds by transmitting back a message giving the airplane's altitude, airspeed, heading, bearing and

Data Link Competition

The newly announced Tacan data link is certain to run into heavy competition both for Common System and military use. Competent observers say its chances of getting the Navy's production nod are less than 50/50.

Principal competition in the military field comes from a new USAF/Navy system under development by Radio Corporation of America. The new RCA system employs time-division, narrow-band techniques—some of them developed by Bell Telephone Laboratories in a Navy sponsored program. The new system is slated to replace the General Electric developed one-way data link now used by the USAF's Air Defense and Tactical Air Commands. The GE system is a frequency-division type. Both the GE and RCA systems operate in the UHF band, utilize communications transmitters and receivers.

It is doubtful whether the new RCA system will be declassified for civil use for some years. However, many of the techniques used in the system may not in themselves be classified, hence could be used in a civil version. Bell Telephone Laboratories representatives recently sounded out the military on this very question and reportedly received a tentative approval.

For Common System use it is not necessary that civil and military aircraft both use the same data link system; providing the two do not interfere with one another.

One of the Tacan data link's big advantages for its original intended use aboard aircraft carriers may work to its disadvantage for civil use. The idea of a single integrated system capable of providing navigation, data-link communications and automatic position reporting has many advantages in a space-cramped fighter which has practically no enroute communications with different ships.

However, for civil use some observers question whether it is wise to have a data link which operates through the navigation receiver-transmitter instead of through the regular communications channels. This means, for example, that data link messages go to and from Vortac-Tacan stations and must then be relayed by telephone lines to one or more Air Route Traffic Control Centers or airports.

Another problem arises because Tacan operates at 1,000 mc. where blind spots or nulls in aircraft coverage are much more serious than at lower VHF frequencies used for civil aviation. This problem could prove more troublesome for the data link feature of Tacan than for its navigation service.

Perhaps the most serious political obstacle is the private flyer. To obtain data link service he will have to equip his airplane with a Vortac DME at a cost of $3,5,000 plus the data link adapter whose cost might run in the same neighborhood.

On the other hand, some observers question whether it will be possible to develop any civil data link system which meets the needs of the airlines and still fits the pocketbook of the private flyer. Even the Melpar developed system, which is a sort of slow-scan TV, would require the private flyer to equip his airplane with a small cathode ray tube display although the system might be able to work through existing VHF communications receivers.

In any case it seems certain that disclosure of Tacan data link details will focus industry attention on the growing need for some sort of data link system and the necessity of concerted industry action to spell out its operational needs.

distance from the station as well as any routine message that the pilot has set up to transmit to the ground.

The data link and DME transmissions take place almost, but not exactly, simultaneously without any adverse effect on the other.

Interleaved Transmissions

The airborne transmitter interrogates the ground station for distance information at a rate of 24 times a second during normal operation, with an interval of about 41,000 microseconds (milliseconds of a second) between each interrogation. The time required to make each interrogation is roughly 3,000 microseconds at a distance of 250 miles, proportionately less when the airplane is closer to the station.

Thus the airborne DME transmitter-receiver has roughly a 38,000 microsecond interval of inactivity between each DME interrogation. It is during one of these free intervals that the data link message is received and replied to by the airborne equipment.

The incoming message takes approximately 2,918 microseconds to transmit and the outgoing reply requires 2,272 microseconds according to FTL.

Despite the fact that a ground Vortac-Tacan station may be serving 100 or more aircraft simultaneously in replying to their DME interrogations, it too has considerable free time. (Each aircraft interrogation occupies about 50 microseconds of ground station time compared to 3,000 microseconds for airborne equipment.)

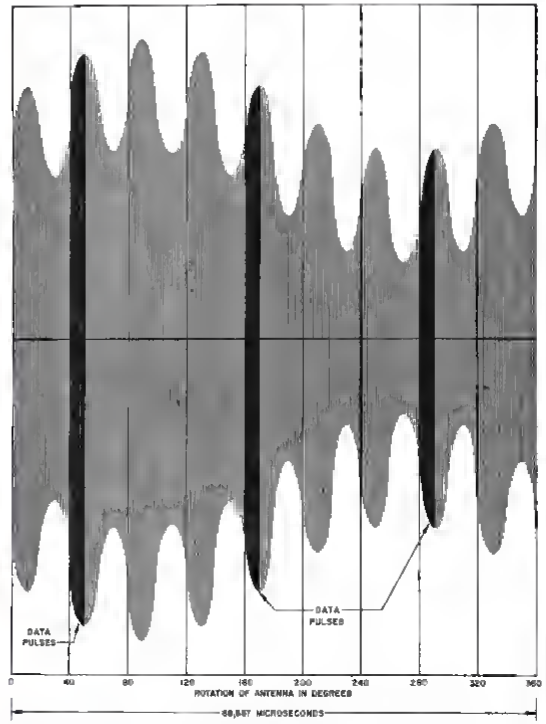
Continuous Transmission

As a matter of fact the ground station must continuously transmit a high density of pulses in order to provide the Tacan omnidirectional bearing service whether or not it is being interrogated by a large number of aircraft. The ground station therefore is designed to transmit approximately 2,700 pulse pairs per second, filling in with random spaced pulses whenever there are not sufficient DME interrogations to produce this density. (AW Sept. 26, 1955, p. 56.)

When the new data link feature is added, the burst of pulses used to convey the ground-to-air message is substituted for these filler pulses or for replies to airborne interrogations. So far as the airborne Tacan receiver's bearing determination is concerned, it detects no difference, FTL says.

The ground station interrupts its transmission of filler pulses or DME replies 45 times every second to transmit a data link message to an individual aircraft and to await its position report and reply. At this rate the system can transmit and receive messages from 120 aircraft in roughly 2½ seconds.

FTL presently quotes a figure of 120



TACAN data link messages go out 45 times per second from ground station instead of DME replies or filler pulses. Tacan bearing-distance functions are not adversely affected

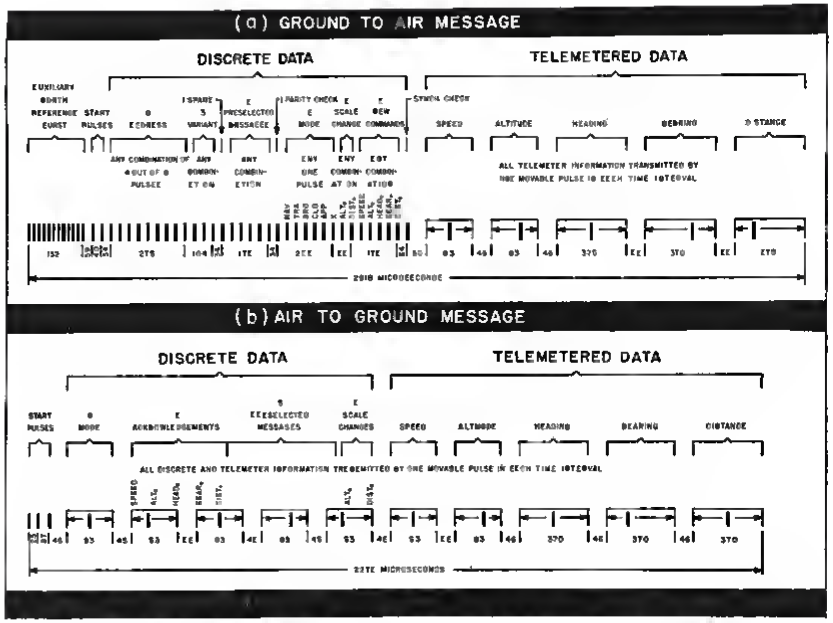
aircraft as the maximum number that can obtain DME data link service from a single Vortac Tacan station. This figure is somewhat higher than the 100 aircraft figure previously thought to be the limit for Tacan operation. Recent FTL tests suggest that the figure can be raised to something approaching 150 aircraft according to Ben Alexander, director of FTL's electronic systems laboratory.

The capacity of a single Tacan Vortac station with data link is limited by its DME service capability rather than by data link, and the former in turn is limited by the 5 kw. peak power available from existing Tacan ground stations, according to P. C. Sandretto, vice president and technical director of FTL.

When a Tacan Vortac station is transmitting data link messages to 120 aircraft, this function occupies less than 10% of its total transmission time.

Because aircraft DME interrogations reach the ground station on an entirely random basis, one (or more) may arrive at the instant that the ground station is transmitting a data link message in which case there will be no DME reply. However, the next interrogation from that particular airplane should arrive at an instant when the ground station is not so occupied since the airplane interrogation occurs at a rate of 24 per second and the data link transmissions occur at a rate of 45 per second.

Failure to receive a single DME response poses no problem for the airborne Tacan Vortac equipment since it is designed to operate satisfactorily when it receives as few as 50% replies to its interrogations. This capability is necessary even without data link since an aircraft DME interrogation can ar-



DATA link messages employ both binary coding and pulse-position modulation. Each pulse shown represents pulse-pair.

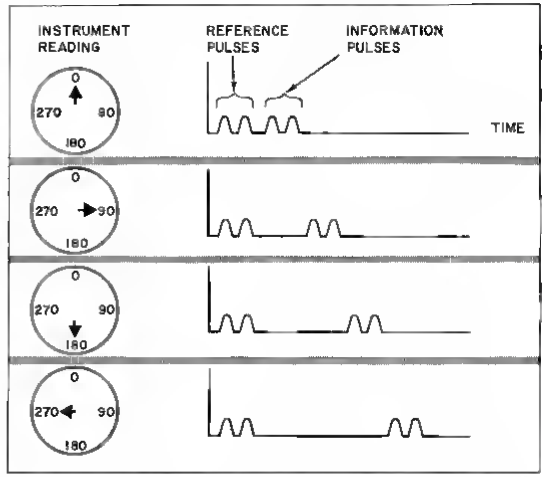
nve when the ground station is occupied replying to another aircraft. In radar beacon terminology, receipt of 50% replies is referred to as a "50% countdown."

Alexander says that the addition of data link service does not increase the normal Tacan countdown by more than 10%, thus does not interfere with navigation service under normal conditions.

The same synchronizing signal now transmitted by a Tacan ground station at 1/135 second intervals to permit the airborne receiver to determine airplane bearing also serves as a synchronized signal for coding and decoding data link messages. As in the basic Tacan-Vortac DME, pairs of pulses are used in the data link message, instead of single pulses, to make the system less susceptible to spurious noise.

The ground-to-air message (see sketch, above) consists of 35 pulse pairs employed as follows:

- **Start Pulses** (two pair) transmitted 59 microseconds after the end of the regular Tacan reference signal, initiate the start of timing and decoding circuits.
- **Address Pulses** (four pair) are trans-



PULSE-POSITION modulation is used to transmit both desired and actual aircraft position.

mitted in any four of nine possible time slots or positions, providing 126 different possible addresses. If the four pulse pairs arrive in the proper position coinciding with the individual airplane's assigned code, the message is passed, otherwise it is rejected. If any more or less than four pulse pairs are received, the message also is rejected.

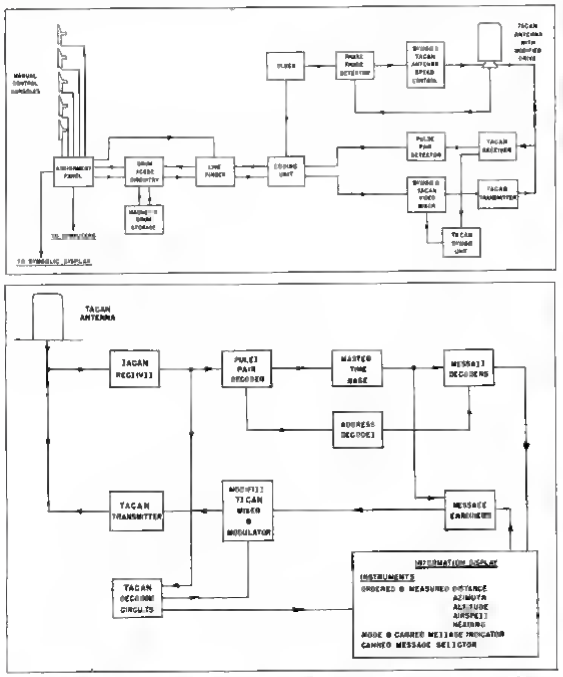
▲ **Variant Address Pulses** (three pair) permit a pilot-adjusted modification of airplane identity code in the event that two aircraft with identical address codes are operating into the same station. For civil use these variant pulses could be used to provide an increased number of basic airplane identity codes.

• **Spare** (one pair).

• **Preselected Message Pulses** (six pairs) One, two, three, four or five pulse pairs are transmitted in a binary code which provides 31 different possible routine messages. The parity check pulse pair is transmitted, when necessary, to make the total number of pulse pairs transmitted in this section of the message equal to an even integer, i.e. 2, 4, 6. This checks that no pulse pair was lost or gained which could cause an incorrect selection of message to be displayed in the cockpit.

▲ **Mode Pulses** (six pair). This part of message shows pilot whether he is under control (and in communication with) traffic control, approach control, landing control, tower, etc. A single pulse pair conveys this information by its position in any one of six different possible time slots. This part of the message also serves to check on spurious noise, since there should be a pulse in only one of the six time slots, none in any of the others. If there are two or more pulse pairs, the data link disregards the message and "listens" for the next one three seconds later. If it finds more than one pulse pair in this part of the message on three successive times, it automatically drops red warning flags on all data link instruments to indicate that the system is not performing properly.

• **Scale Change Pulses** (two pair). The military system uses distance measuring



BLOCK diagram of Tacan data link shows modification and additional elements required for message coding and decoding in ground station (above) and in airborne equipment (below).

COCKPIT console (right) enables pilot to transmit routine messages. Ground-to-air messages are displayed on panel instrument (center) and on dials of conventional indicators.

and altitude indicators with a choice of scales. For example, distance can be displayed with a 20 or 200 mile scale. The ground controller can use data link to switch scale on these instruments. When this is done, scale change pulses are transmitted to drop a yellow warning flag on the cockpit instrument to call the change to the pilot's attention. He acknowledges by pushing a button which raises the yellow flag and transmits an acknowledge message to the ground.

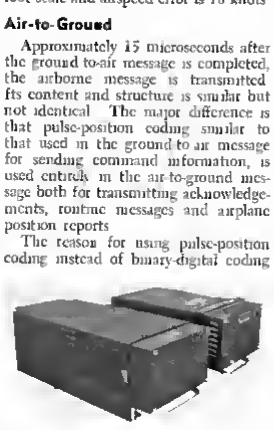
- **New Command Pulses** (five pair) are used to alert the pilot that changes have been made in the desired (command) altitude, airspeed, heading, bearing or distance which he should assume. The pulses actuate warning lights or flags on the particular instrument involved. By pushing a button, the pilot automatically acknowledges receipt of this warning to the ground.
- **Synch Checks Pulses** (one pair) provide a time base check on the message decoding at its midpoint, just prior to decoding the magnitude of commands from the ground. If the synch check is off by more than two microseconds, the complete message is disregarded.
- **Command Data Pulses** (five pair) provide the information for positioning markers on the cockpit panel indicators showing the pilot the altitude, airspeed, heading, bearing and/or distance that the ground controller wants the airplane to assume. Pulse position modulation is used to transmit this data, with the time base position of the first pulse pair proportional to command airspeed, the time base position of the second pulse pair proportional to command altitude, and so on. Because less accuracy is required for speed and altitude, a briefer time base is used. FTL says that heading and bearing can be transmitted with an error of no more than one-half degree, distance error is only one half mile on the 200 mile scale, altitude error is only 500 feet on the 50,000 foot scale and airspeed error is 10 knots.

Air-to-Ground

Approximately 15 microseconds after the ground-to-air message is completed, the airborne message is transmitted. Its content and structure is similar but not identical. The major difference is that pulse-position coding similar to that used in the ground-to-air message for sending command information, is used entirely in the air-to-ground message both for transmitting acknowledgements, routine messages and airplane position reports.

The reason for using pulse-position coding instead of binary-digital coding is the fact that the latter technique requires the transmission of more pulse pairs which would overload the existing airborne Tacan Vortac modulator which can only handle 125 pulses per second.

Although the Tacan data link is capable of transmitting and receiving messages from 120 aircraft in 2½ seconds, under certain conditions it may be desirable to contact individual aircraft more or less frequently. For example, during final approach, or during critical phase of an intercept, it may be desirable to send "command" data every second or less. However, this means either that fewer aircraft can be served or that some aircraft must accept data link messages at a slightly slower rate.



MILITARY Tacan data link shown in prototype version (front) alongside airborne Tacan receiver-transmitter.

Magnetic Storage

Data link messages are stored on a magnetic drum prior to their transmission. When the message is prepared by the ground controller or automatic computer, it specifies a "service rate" i.e. the frequency at which the message should be transmitted to each aircraft. Present service rates range from 0.2 second to 6 seconds.

Messages are stored on the drum in a different digital code language from that used in the data link message, hence must be recoded prior to transmission. A line finder scans the stored messages and their specified service rates to be sure that they go out on schedule.

If the specified service rates can not be met with current traffic loads, then the system automatically cuts back all aircraft, except those getting the most rapid service (in final approach), to the next slower service rate, FTL says.

The magnitude drum also is used to store the most recent aircraft position reports and messages. The position reports are compared with the last reported position speed-altitude to check the accuracy of the latest report. If there is too great a deviation, suggesting a possible message disturbance, the latest report is ignored, FTL says.

Any number of users including airlines and several traffic control centers, located remote from the storage drum, can interrogate it to obtain position reports on individual aircraft using only normal telephone circuits, FTL says. The storage drum could be located at an Air Route Traffic Control center, connected by long lines to a distant Vortac Tacan site where the data link decoding and encoding equipment was installed.

FTL President Henri C. Busignies reports that the company is currently testing a Tacan instrument approach system, providing a 1,000 mc localizer and glide slope. The former is being developed under Air Force sponsorship, the latter with FTL funds.

The present airborne Tacan data link

Midget Computor

Midget all transistor digital computer, called RECOMP, developed by North American Aviation's Autonetics Division, is a general purpose machine, ruggedized for transportability and weighing only 200 lb. Unit shown was built for Rome Air Development Center. Computer has built in self-checking circuits which reportedly eliminate input-output errors, automatically verify stored information. Accessory test console speeds trouble-shooting and maintenance.

adapter which the Navy currently is evaluating weighs about 50 pounds, occupies a volume of one cubic foot, and uses 159 vacuum tubes—roughly twice the number used in the basic Tacan set.

However, any military production design probably would be transistorized, according to Alexander and probably would employ around 250 transistors.

FTL currently is developing a stripped-down transistorized version of the Tacan data link for possible civil use.

It provides all of the aircraft position reporting and two-way push button communication features of the military version but has no provisions to enable the ground controller or computer to display desired (command) position, altitude, airspeed and heading information in the cockpit.

This stripped-down civil version will weigh about 14 pounds, occupy a ½ ATR size case, FTL's Sandretto says.

Expansions, Changes In Avionics Industry

Datics Corporation, Ft. Worth, Texas, is name of newly formed company which will provide research, development and consulting services in field of computers and data processing. Kenneth L. Austin is president. Address: 6000 Camp Bowie Blvd.

Other recently announced expansions

and changes in the avionics industry include:

▪ **Servionics, Inc.**, West Hempstead, L. I., is name of another new firm this one specializing in automatic controls and instrumentation. President is Joseph D. Mazzagha, formerly with Servomechanisms Inc. Address of new company: 413 Hempstead Turnpike.

• **Aviation Instrument Manufacturing Corp.**, Houston, Texas, (formerly Allied Instrument Mfg. Corp.) has broken ground for construction of new $50,000, 5,100 sq. ft. engineering and manufacturing facility. Company makes line of lightweight aircraft instruments.

▪ **Alwac Corp.** is new name of the former Logistics Research Corp., Hawthorne, Calif. Company recently moved to Hawthorne from its previous Redondo Beach location.

• **International Electronic Research Corp.**, Burbank, Calif., maker of heat dissipating tube shields, has acquired new building at 145 Magnolia Blvd. which more than triples original manufacturing space.

▪ **Edo (Canada) Ltd.**, is name of wholly owned subsidiary formed by Edo Corp., College Point, L. I., N. Y., maker of avionic and aircraft products. Company plans to build Canadian facilities near Cornwall, Ontario for new subsidiary.

Antenna Selector

Antenna selector automatically switches UHF communications and Tacan receivers from antenna in airplane's vertical fin to a belly antenna, or vice versa, to obtain optimum reception. Previously pilot had to manually switch from one antenna to the other or a coaxial tee was used that seriously reduced signal strength. Device was developed by North American's Autonetics Division for use on F-100F but has been adopted by Air Force for use in other aircraft. Device uses transistors throughout, weighs 2¼ lb., consumes only 70 milliwatts of power and measures 4 x 5 x 6 in.

Shipboard Servicing for Seaplanes Tested

Complete shipborne servicing and repair facility for large seaplanes is shown during Chesapeake Bay demonstration. The vital element in the operation of independent, long-range seaplane striking forces is being developed further to accommodate the transonic P6M SeaMaster. Exercise with Martin P5M Marlin antisubmarine aircraft and LSD (Landing Ship Dock) was conducted for benefit of Navy officers and Martin engineers. Stern of the LSD is ballasted down 13 ft (top). Marlin beaching gear is floated to the aircraft and attached (above, left). Seaplane is balanced by beaching gear as tie-down is completed, and LSD stern is raised (above, right). Major repair begins (below).

NEW AVIATION PRODUCTS

Accelerometer

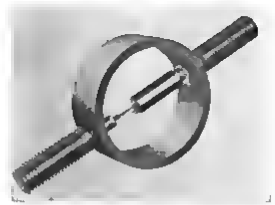
Accelerometer for high speed aircraft, missile and fire control applications is available in variations designed to MIL-E 5400 and MIL-E-5272A. It is in use in USAF's North American F-100. Movable copper mass is supported by parallelogram spring providing almost friction-free straight line motion. Potentiometer brush on mass is moved along resistance winding by accelerations parallel to sensitive axis. Mass travel in all other directions is restrained. Stops limit overtravel of mass permitting instrument to withstand high acceleration shocks. Damping is provided by eddy currents generated as mass moves through field of permanent magnet. Filling hermetically sealed case with silicon fluid reduces internal resonance, provides resistance to vibration and adds slightly to total damping. Balanced range models are available in ranges from ±1G to ±8G or up to 30G with reduced damping. Ultra sensitive ones can be made with ranges as low as ±0.1G.

Genisco, Inc., 2233 Federal Ave., Los Angeles 64, Calif.

Missile Lubricant

Chlorofluorocarbon grease, called Halocarbon Crease Series 25-10, is a blend of low molecular weight polymers of chlorotrifluoroethylene containing no silica, soap or other non-halogen thickeners. It is inert to such rocket propellants as fuming nitric acid and 90% hydrogen peroxide as well as compressed oxygen, mixed acids, caustic solutions and various halo-fluoride gases. The new grease has been field tested by several oxygen plants as a plug-cock lubricant and has been accepted where other materials have failed because of chemical reaction or poor thermal stability. Crease characteristics are retained in a temperature range from 30F to 275F. Above this temperature it is a good clear oil lubricant to 550F. Modifications are being offered for special conditions as low temperature or low vapor pressure.

Halocarbon Products Corp., 82 Burlews Ct., Hackensack, N. J.



Load Transducer

Variable permeance rectilinear force or load transducer has less sensitivity to temperature changes than linear variable differential transformers or strain gages. Repeatability is nearly 100% and resolution is limited only by external circuitry. Control system available permits full scale readout to be set for less than one-tenth of full range, making transducer useful for many force or load ranges. It senses either compression or tension without mechanical adjustment.

Crescent Engineering and Research Co., 5440 N. Peck Rd., El Monte, Calif.

Precision Spectrometer

High precision spectrometer to check angles of prism faces, gage block combinations, instrument assemblies, etc. is accurate to 0.1 sec. of arc. One divided circle is used to read both specimen table and telescope positions. Table and telescope can be rotated independently and with or without the circle.

One telescope is mounted on the main bearing and the other is mounted on a swinging pillar. Both have micrometers at the eyepiece ends which can be rotated through 90 deg. from the horizontal for vertical measurement. A collimator, also on a pillar, can be set anywhere on the ring. Its objective is larger and of longer focus than the telescope objective.

Engis Equipment Co., 431 S. Dearborn St., Chicago 5, Ill.

IR Detector Cooler

New series of nitrogen cryostats which can cool infrared detectors to about —196C is available for both military and laboratory applications. Cryostats are completely closed recirculating sys-

Stronger Propeller for Super Constellation

Hamilton Standard has begun deliveries of a three bladed propeller for advanced versions of the Lockheed Super Constellation. Propeller, designated 43H60 reversible hydromatic, is 15 ft. in diameter, has stronger hub and stronger solid aluminum alloy blades.

tems with no danger of spilling or loss by evaporation. Cooling heads and thus the detectors can be moved or rotated while operating. Laboratory model consists of miniature cooling head and compressor-regulator using Joule-Thompson effect and principle of regenerative cooling. It is designed to

operate on nominal 117 VAC power supply. Military model is extremely light, meets JAN specifications, is packaged for airborne installations and operates on 28 VDC. It consists of three parts pump regulator and cooling head. Heads with heat pumping capacity of 1.5 to 5 watts are available to fit wide range of sizes and shapes of re-entrant Dewar detector units.

Perkin-Elmer Corp., Norwalk, Conn.

Vibration Instrument

Optical displacement and vibration measuring instrument may be used with shape, size or composition of specimen. It measures amplitude, frequency and wave form of shake tables, vibration

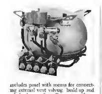
pickups, accelerometers, relay contacts, etc.

No contact is made with the work. A .0001-in. light spot from a cathode ray tube (frequency response 1 mc.) is projected by a 100 X microscope onto the work. A multiplier photocell servos the spot to follow motion.

Optron Corp., 3526 State St., Santa Barbara, Calif.

Oxygen Converter

New 5-liter liquid oxygen converter offers improved performance through use of an economizer circuit. Circuit takes supply from the top or vapor phase of the container during periods of excessive pressure, utilizing oxygen which would otherwise be dumped by a relief valve. Increased efficiency prolongs flow, reduces valving. Equipment



includes panel with means for connecting external vent valving build up and relief valve overflow. Connections functioning from an integrally mounted capacitance probe are provided for capacitance-type gaging system. Single cast housing holds pressure opening valve and pressure closing valve which operate reciprocally to regulate economizer flow.

Aro Equipment Corp., Bryan, Ohio.

USAF Contracts

Following is a list of unclassified contracts for $25,000 and over, as released by Air Force Contracting Offices.

AIR FORCE MISSILE TEST CENTER, Patrick Air Force Base (ARDC) Fla.

Cubic Corp., 2841 Cannon St., San Diego 6, Cal., improvement and expansion of ecigs system (PR FP-1-(56)-342, FP-1(56)-353, FP-1(56)-404) job $350,549.

Nems-Clarke Inc., 919 Jesup-Blair Drive Silver Springs, Md., telemetry receiving racks, (PR FP-1(56)-437) 60 ea. $681,416.

Consolidated Electrodynamics Corp., 300 N. Sierra Madre Villa, Pasadena, Cal., magnetic tape recorder reproducer systems (PR FP-1(56)-426, FP-1(56)-461, FP-1(56)) job $1,216,458.

Electronic Engr. Co. of Cal., 180 S. Alvarado St., Los Angeles, Cal., subcentral timing units and central timing units modifications, (PR FP-1(56)-436) job $639,764.

General Dynamics Corp., (Convair Div.) San Diego 12, Cal., services and materials necessary to design, fabricate and/or procure equipment to effect modification of the experimental AN/FRW-(XW-1) system (PR FP-1(56)-425) job $208,286.

G. M. Giannini & Co., Inc., Detex Div., 1307 S. Myrtle Ave., Monrovia, Cal., study tests and fabrication kits for the improvement of the AFMTC precision radar data recorder (PR FP-1(56)-465) job $137,654.

Radiation Inc., Melbourne, Fla., telemetry receiver recorder vans, (PR FP-1(56)-484) 6 ea. $473,182.

Nems Clarke, Inc., 919 Jesup-Blair Drive Silver Spring, Md., radio frequency recording monitors (PR FP-1(56) 477) job $328,206.

General Dynamics Corp., (Convair Division) San Diego 12, Cal., additional services and materials to continue tests maintenance and development of the AN/FRW-1 (XW-1) system. (PR FP-1) (56) 287 job $248,567.

Canoga Corp. of Cal., 5955 Sepulveda Blvd., Van Nuys, Cal., modification kit for improvements to radar tracking AFMTC Mod II (PR FP-1(56)-381) job $221,175.

New York University, College of Engineering Research Div., University Heights, New York 53, N. Y., study of error and reliability of AFMTC trajectory measuring systems, (PR FP-1, 56)-393) job $176,606.

General Dynamics Corp., (Convair Div.) San Diego 12, Cal., design, fabrication,

installation and operation of an interim impact predictor instrumentation system, (PR FP-1(56) 360 job $246 000

Panoramic Radio Products, Inc. 10 Second Ave. Mount Vernon N. Y. design develop and fabricate a telemetry ground station. (PR FP-1(56)-252 job $82 084

AIR FORCE OFFICE OF SCIENTIFIC RESEARCH Air Research and Development Command P O Box 1395 Baltimore Md.

American Machine & Foundry Co. 12276 Montague St. Pacoima Cal investigation of rational scaling procedures for liquid fuel rocket engines (AF 18(603)-107) job $144 974

The Rand Corp., 1700 Main St Santa Monica, Cal. continuation of research study and reports (AF18(600)-1600) job $144 167

The Regents of the University of Minnesota Minneapolis 14 Minn continuation research in "Theoretical and experimental studies of mass transfer cooling" (AF 18(600)1261 job $123 026

Aerojet-General Corp. Azusa, Cal., research on ultra-energy fuels for rocket propellants (AF 18(603)-116) job $136 926

The University of Chicago 5801 Ellis Ave., Chicago 37 Ill., research on semiconductors and physical electronics (AF 18(603)-0) job $200 000

OGDEN AIR MATERIEL AREA Hill AFB Utah

Massillon-Cleveland-Akron Sign Co., 631 First St. S.W. Massillon Ohio tow target (IFB 42-600-56-349) 2 000 ea. $238 200

Arthur Fralich Co. 3008 E. 57th St. Seattle 5 Wash. erection of seven (7) AC & W towers including foundations and cable trenches (IFB 42-600-56-320) job $188,037

AMC Wright-Patterson AFB Ohio

North American Aviation, Inc. Downey Cal facilities in support of the WS-104A program (PR 701110 & 701111) $70 000

Royal Jet Inc., 1024 Westminster Ave Alhambra, Cal tank assemblies 275 gallon capacity, type 11 (PR 573441 & 573441-1) 10144 ea. $2 867 020

The D A Sutton Corp., 1012 W Second St Wichita 1 Kan. tank assemblies 275 gallon capacity type 11 (PR 537441 & 537441 1), 10445 ea $2 876 405

Beech Aircraft Corp., 9709 E Central Ave. Wichita 1 Kan. type MA-3 multi-purpose servicing units ground towing air start electric and air servicing for 160 aircraft support (PR SM 851110). $2 020 584

I B General Products, Inc., 11 W 30 St. N Y 1 N Y., film slide recognition kits (PR 364698) 529 ea $109 270

Solar Aircraft Co., 2200 Pacific Highway San Diego Calif gas turbine compressor type MA-2 (GFE for MA-3 MPSU) 30 ea; gas turbine compressor type MA-2 26 ea; (PR 801110 718181) $2 495 417

Marmon Herrington Co. Inc. 1511 W Washington St Indianapolis 7 Ind type MB-1 aircraft fire fighting truck 11 ea., spare parts for one MB-1 truck 1 ea (MIPR R-50-1665-151-Arr & Amend 1 and 2) $472 247

Ward LaFrance Truck Corp., Elmira, N Y. type MB-5 aircraft fire fighting truck publications, handbooks 1 set, (MIPR R-56-1666-102-Arr and Amend 1) $1 536 790

Continental Aviation & Engineering Corp., 12700 Kercheval Ave., Detroit Mich. J-69-T-19A engines, AEK0201 (PR 666640 Q), $787 509

Minneapolis-Honeywell Regulator Co., Aeronautical Div., 2600 Ridgeway Road Minneapolis Minn., Ne-3 lab systems spare components spare parts (PR 216596) 477 ea., $2 171 483

Studebaker-Packard Corp., 1560 E Grand Blvd Detroit 32 Mich develop manufacturing plan for J-57-P 21 (PR 196278) $657 852

Lear Inc., 110 Ionia Ave., N W Grand Rapids Mich MC-1 automatic flight control system application KC-135 aircraft data (PR PE 700771 Q), $1 592 041

Houston Fearless Div., Color Corp. of America 11801 W Olympic Blvd Los Angeles Calif SNR-splicer & rewinder photo

film FM-16, 161 ea. S/L splicer and rewinder, photo film FM-16 1382144-50 (PR 730095 MIPR's R 157 ORDDW R-41204 2422-ASO R55-11-2210-ASO R55-167 23775-ASO), $102,425.

The G. W. Borg Corp., Borg Equipment Div. 100 S. Main St., Janesville, Wis., indicator ID-250A/ARN, 321 ea. indicator ID 251/ARN 568 ea. (PR 572782 601051 and 670784), $456,440.

Allison Div.-Aeroproducts Operation General Motors Corp., Dayton 1, Ohio, hubs, P/N 0502503 (PR WR 420-700), 70 ea. $250,200.

Collins Radio Co., Cedar Rapids, Iowa, transceiver 618S-1, spare parts and data, receiver transmitter 618S-1 285 ea. tuning unit 180L-3 325 ea. power supply 416W AZA6810S 207 ea. (PR 122687 503253-1, 032253-2, 663266, 633267, 628703), $1,427,407.

Com-Stal Inc., 11031-39 Olympic Blvd., Los Angeles, Cal., 0446 A40-1-1 actuators trim tab 123 ea. maintenance data (PR SA-611301 and 611301-1), $25,020.

Seaboard Electric Co., 417-421 Canal St., N. Y. 13, N. Y., flasher position light, type C-2 in a/w spec. MIL-F-7414 10,000 ea. spare parts (Committed) 5359 ea. (PR SA 611020, 611207, 510150, 503207), $423,475.

Clinr Products Supply Corp., Evesham Ave. Ashland, N. J., spare parts of various quantities for 16mm motion picture projectors. (MIPR R56 90010-SPCC R56 07054-SPCC and R56-22634-SPCC), $120,508.

Continental Motors Corp., 205 Market St., Muskegon, Mich., PE 200-2 package engine, spare engines, (PR SM-551110), $243,920.

Air Products, Inc., P. O. Box 538, Allentown, Pa., type A-1A liquid oxygen and nitrogen generating plants, 17 ea. type MA 2 liquid oxygen and nitrogen generating plants, 2 ea. spare parts for above plants, bulk (PR ML-560142, ML-560545, ML 563-465), $1,184,052.

Continental Motors Corp., 205 Market St., Muskegon, Mich., PE 150-6 package engines, spare engines, engineering data (PR SM-503730, 500752, 551100), $4,039,493.

Fostamble-Aviation Corp., 5031 W. Century Blvd., Los Angeles 45, Calif., tank assembly 200 gallon capacity external fuel type 111 suitable for installation on F80F and F86 H aircraft (PR 612015), $25,505.

C. J. Glasgow Co., 14020 Oakland Ave., Detroit 3, Mich., metal buildings for dehumidified storage of war reserve machine tools (PR 152971), $396,422.

The Newton Co., 56 Elm St., Manchester, Conn., cockpit procedures trainer maintenance data engineering data, (PR 671930), $965,2.

The Steel Improvement & Forge Company, 970 E. 64th St., Cleveland, Ohio, facilities for the production of J57 engine components (PR 765342), $800,000.

Utica Drop Forge & Tool Co., Utica, N. Y., facilities for the production of J79 engine components. (PR 673012), $590,000.

Douglas Aircraft Co., Inc., GAP #5, Tulsa, Okla., additional facilities for use in B-47 IRAN modification (PR 670572), $175,000.

General Dynamics Corp., Convair AF Plant No. 4, Fort Worth, Tex., additional facilities for an aircraft decontamination facility (PR-673120), $61,000.

Boeing Airplane Co., Seattle, Wash., facilities for the evaluation testing and installation of bombing navigational and radar systems for B-50 aircraft (PR 701110), $535,000.

Kelsey-Hayes Wheel Co., Detroit 32, Mich., acquisition, installation and rehabilitation of Machinery and equipment, laboratory and testing equipment for the production of J57 engine components (PR 672-000, 500050), $2,700,000.

Utica Drop Forge & Tool Co., Utica, N. Y., facilities for the production of J57 engine components, (PR 50040, 562643), $1,400,000.

General Electric Co., Evendale, Ohio, acquisition, installation and rehabilitation of facilities, (PR 673087), $6,135,874.

Boeing Airplane Co., Seattle, Wash., facilities for the production and flight testing of B-52 aircraft, (PR 701120), $993,000.

Navy Contracts

Following is a list of unclassified contracts for $25,000 and over, as released by Navy Contracting Offices.

DISTRICT PUBLIC WORKS OFFICE, Eleventh Naval District, San Diego 32, Cal.

Diversified Builders Inc., 1610 Greenwood Ave., Montebello, Cal., high altitude bombing range, U. S. Naval Ordnance Test Station, China Lake, Calif., contract NBy-5423 (IFB 54256/5B) job, $278,303.

West Liberty Lumber Co., 1311 West Liberty Ave., Pittsburgh 26, Pa., Aero 33A plywood dart tow target (303/2155-81A0/352ABRO) 2,000 ea. $239,833.

NAVY PURCHASING OFFICE, Washington, D. C. 4th & Independence Ave. S.W., Washington

Gramco, Inc., 3535 N. Sylvania, Ft. Worth, Tex., mobile air transportable service units (N600(A)42410) (IFB 600-1074-56), 7 ea. $663,700.

Stewart Steel Products, Inc., 1780 E. New York Ave., Brooklyn, N. Y., Regulus mobile missile dollies (N600(A)42402) (IFB 600-1296-56), 20 ea., $47,920.

AVIATION SUPPLY OFFICE, 700 Robbins Ave., Philadelphia 11, Pa.

Kaiser Aluminum & Chemical Sales Inc., 219 N. Michigan Ave., Chicago 11, Ill., aluminum alloy (IFB-383-1851-56), various $109,352.

Auld Co., East 5th Ave. & 5th St., Columbus 1, Ohio, aircraft mooring reels. (JD-IFB-383-1060-56), 2110 ea., $120,176.

BUREAU OF AERONAUTICS, Washington 25, D. C.

Texas Instruments, Inc., 6000 Lemmon Ave., Dallas 9, Tex., APS-40 radar sets, NOas 55-577-f (PD-31-757-56 & Change A) $783,511.

The Siesog Electric Corp., 37 City Park Ave., Toledo 2, Ohio, components of AVQ-2 searchlight, NOas 55-595-i (PD-23-720-561 76), $220,023.

Admiral Corp., 3800 Cortland St., Chicago 47, Ill., ARC-33 radio receiver-transmitters and mountings, NOas 56-570-f (PD-32-759-56), 216, $345,040.

Sprague Engineering Corp., 2144 West 190th St., Gardena, Calif., portable hydraulic test stand model S-050, NOas 56-579-f (MA 43-5151-56), 26, $120,022.

Lavoie Laboratories Inc., Matawan-Freehold Road, Morganville, N. J., Radar beacon systems, DPN NOas 56-1063-f (PD 23-217-56), 224, $301,864.

Army Contracts

Following is a list of unclassified contracts for $25,000 and over, as released by Army Contracting Offices.

LOS ANGELES ORDNANCE DISTRICT, 55 S. Grand Ave., Pasadena, Calif.

California Institute of Technology, 1201 East Calif. St., Pasadena, Calif., for engineering and development, job, $2,655,000.

Gilfillan Bros., 1815 Venice Blvd., Los Angeles 6, Calif., Repair parts, job $750,000.

Firestone Tire & Rubber Co., 1520 Firestone Blvd., Los Angeles 54, Calif., engineering services, job, $1,400,000.

Consolidated Western Steel Division, 5700 South Eastern Ave., Maywood, Calif., Nike B. Facilities, job $813,130.

California Institute of Technology, 1201 East California St., Pasadena, Cal., Engineering Research and development job $1,041,500.

CORPS OF ENGINEERS, U. S. Army Office of the District Engineer, Tullahoma Dist., P. O. Box 2221, Tullahoma, Tenn.

Westinghouse Electric Corp., 308 Volunteer Bldg., Chattanooga, Tenn., furnishing compressor drive and lubricating system and switch gear for gas dynamics facility, Arnold Engineering Development Center, Tullahoma, Tenn., (IFB ENG-40-126-56-54) Contract No. DA-40-126-eng-240, job, $143,000.

CAB Accident Investigation Report:

Victim's Own Error Held as Cause of Fall

A passenger on Piedmont Airlines Flight 5, DC-3C, N 45V, fell to his death through the main cabin door from an altitude of 6,500 feet, near Shelby, North Carolina, at approximately 1807,[1] June 13, 1956. The crew and other passengers were not involved in the accident. The air stair door received minor damage during the inflight opening and subsequent flight to a normal landing at Asheville, North Carolina.

HISTORY OF THE FLIGHT

Piedmont Airlines Flight 5 originated at Fayetteville, North Carolina, destination Louisville, Kentucky, with intermediate stops at Charlotte and Asheville, North Carolina, and Tri Cities, Tennessee. It departed Charlotte at 1744, six minutes late, with Captain Baxter B. Slaughter, Jr., First Officer Henry A. Schulze, Jr., and Purser Bert R. Barnes as crew members, and 24 passengers. Seated in next to the rearmost pair of seats on the left side were Mr. and Mrs. Oren A. Pruitt, who had been transferred to Piedmont Flight 5 after arriving at the airport too late to claim their reservations on another carrier's flight that departed Charlotte at approximately 1715.

The aircraft reached 6,500 feet, its cruising altitude at approximately 1806. The seat belt sign has been left on since takeoff because of anticipated turbulence, which had not developed. About one minute later at 1807, while the purser was on the flight deck obtaining information for a passenger, the aircraft suddenly yawed to the left as the cockpit door warning light came on. The first officer and purser immediately went to the rear of the cabin where they found the main cabin door fully open. A woman passenger, who was in the lavatory when the door opened, left the lavatory and was assisted past the open door by the two crew members. A passenger check revealed that Oren A. Pruitt was missing.

The captain circled to establish the location and then proceeded to Asheville, where a routine landing was made. The flight was canceled at Asheville and the aircraft remained there awaiting inspection.

The U. S. Weather Bureau 1728 observation at Charlotte was: Scattered clouds at 25,000 feet, visibility 12 miles.

INVESTIGATION

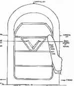
The main cabin of N 45V is equipped with 24 passenger seats and they were all occupied at the time of takeoff. Statements of the other passengers indicate that none of them observed Mr. Pruitt's actions at the rear of the cabin. One passenger, seated immediately in front of the Pruitts, overheard Mr. Pruitt remark to his wife that he was going to the lavatory, or words to that effect. At this time the lavatory was occupied. Other passengers stated that they heard a noise and a rush of air which called their attention to the open door. One passenger, who had been looking out of the window at his right across from the main cabin door, stated that after hearing the rush of air he turned and saw a man trying to hang to the doorframe from outside the aircraft. No other person was near the door.

Investigation disclosed the main cabin door of N 45V to be a Metropolitan Air Stair model A, serial number 2363, located on the left side of the aircraft. Attached to its inner side are five steps, which are an integral part of the door and provide a means of entering and leaving the aircraft when the door is down. The air stair door is hinged at the bottom and opens out and down when the door latch is released.

The door latch mechanism is actuated by a five-inch lever handle pivoted at its lower end and recessed in the center of the step riser between the second and third step from the top of the door when viewed from the closed position. The handle is approximately waist high when the door is closed.

Latching of the door is accomplished by rotating the lever handle approximately 90 degrees counterclockwise through an arc of approximately 6½ inches. This extends three tapered latch pins of 1¾ inches into the door frame in the fuselage. Inspection windows are installed in the fuselage so that engagement of the latch pins can be checked. The lever handle is held in the locked or unlocked position by a detent type friction plate, which is also a part of the latching mechanism.

There are three warning lights installed—one near the outside of the door, another at the purser's station in the cabin and a third on the pilot's instrument panel. When the door is closed and latched all warning lights go off. When the lever handle is moved clockwise or toward the open position approximately one half inch, the three warning lights come on. The handle movement continues more than two inches before the latch pins start to move slowly from their closed position. When the pins are retracted sufficiently for the door to open the lever handle has traveled 70 or 75 degrees of the full 90-degree movement. This 90-degree movement is 45 degrees on either side of vertical. (See attachment A.)



DRAWING shows Piedmont DC-3 door latch.

Door Checked

A test of the subject door after the accident, revealed normal functioning of the latch pins, all warning lights and the latching mechanism. According to the crew, a check of the door warning lights was made for correct door closure prior to takeoff from Charlotte.

Airport personnel and others, were interviewed regarding their observations of Mr. and Mrs. Pruitt before the departure of Flight 5. Their statements give definite indication that the Pruitts had been drinking before their arrival at the airport. Their taxi driver stated: "I could detect the odor of alcohol though the couple was not staggering and there was no disorder."

In the terminal building, they were observed by an airport employee stationed 15 feet from the Capital Airlines counter. Her statement reads (in part): ". . . at the counter both the man and his wife started using dirty English and raising Cain because the agent was not around. In this commotion the man, Mr. Pruitt, knocked the bell (for service) off the counter three times . . . I saw them next at the Piedmont counter being ticketed. Both were obviously under the influence of alcohol. Both had flushed, or red, faces."

The Piedmont agent said of the time they were being ticketed: "The passengers conducted themselves very mannerly, and I was not close enough to smell any liquor on their breath but there was a doubt in my mind because Mr. Pruitt walked a little unsteadily away from the counter. But as he had given me no trouble I let them go."

Alcohol Odor

The purser's statement covers attending Mr. and Mrs. Pruitt after takeoff and reads, in part: ". . . I detected a strong odor of alcohol on the breath of Mr. Pruitt . . ." Passenger statements reflect nothing unusual in Mr. Pruitt's actions or conduct prior to the accident.

The Board has made repeated but unsuccessful efforts to obtain a statement from Mrs. Pruitt.

In the main cabin door installation of

[1] All times referred to in this report are eastern standard based on the 24-hour clock.

N 45V there was no means of preventing the door from fully opening if the latches were inadvertently actuated. Investigation revealed that the door can be opened accidentally.

Many operators of DC-3 aircraft equipped with air stair doors have a safety device installed, such as a quickly removable chain preventing full door opening, or a means of retarding movement of the unsafeguarded door latch handle.

There have been several accidental openings of the air stair door on aircraft operated by other air carriers. These incidents were without fatality or injury because of the installation of safeguards on the door. Since this accident Piedmont Airlines has installed on its entire fleet a means of safeguarding against accidental opening of the door.

As a result of its investigation of this accident, the Civil Aeronautics Board recommended to the Administrator of Civil Aeronautics that an Airworthiness Directive be issued requiring correction of this unsafe condition.

ANALYSIS

The air stair door is a feature of the past few years and it is physically located in the same position as the side-hinged original door of DC-3 aircraft. The appearance of the door with the five integral steps facing the interior suggests only an exit, and it must be remembered that Mr. Pruitt had boarded the aircraft through this door.

As stated, the seat belt sign had been on for the entire 22 minutes of the flight because of anticipated turbulence. However, the turbulence did not develop. In fact, both passengers and crew stated that the flight was smooth. Therefore, it is highly improbable that Mr. Pruitt was thrown against the door by turbulence.

In view of the investigation which found the door latching mechanism normal in its operation, it must be concluded that the passenger opened the door by operating the unlatching handle.

It is probable that Mr. Pruitt, after finding the lavatory occupied, stood in the area by the main door and while there accidentally grasped the door handle and moved it to the open position. This accidental act is substantiated by the statement of a passenger who observed Mr. Pruitt's efforts to retain his grasp of the doorframe from outside the aircraft. A lack of normal acuteness on the part of Mr. Pruitt is suggested by the evidence of his drinking before arrival at the airport.

FINDINGS

On the basis of all available evidence the Board finds that:

1. The aircraft, the carrier, and the crew were currently certificated.
2. Turbulence was not a factor in the accident.
3. The cabin door was closed, latched and inspected by the crew prior to departure.
4. There was no failure or malfunction of the main cabin door.
5. Passenger Pruitt left his seat to go to the lavatory, accidentally opened the cabin door, and fell to his death through the opening.
6. The purser was temporarily absent from the cabin in the performance of his duty.
7. The interior of the door was not placarded or otherwise safeguarded against inadvertent opening, nor is it required.

PROBABLE CAUSE

The Board determines that the probable cause of this accident was a passenger's accidental opening of the main cabin door in flight.

By the Civil Aeronautics Board:

/s/ James R. Durfee
/s/ Chan Gurney
/s/ Harmar D. Denny
/s/ G. Joseph Minetti

SUPPLEMENTAL DATA

The Civil Aeronautics Board was notified of the accident on the night of June 13, 1956. An investigation was immediately initiated in accordance with the provisions of Section 702 (a) (2) of the Civil Aeronautics Act of 1938, as amended.

AIR CARRIER

Piedmont Aviation, Inc., the parent company, conducts a general aircraft sales and service type of operation. The company is incorporated in the State of North Carolina with its principal offices in Winston-Salem, North Carolina. In December 1947 the company established the Piedmont Airlines Division. The company operates under a currently effective certificate of public convenience and necessity issued by the Civil Aeronautics Board, and an air carrier operating certificate issued by the Civil Aeronautics Administration. These certificates authorize the company to transport by air persons, property, and mail between various points in the continental United States, including the route involved.

FLIGHT PERSONNEL

Captain Baxter B. Slaughter, Jr., age 34, held a currently effective airman certificate with an airline transport rating and equipment rating for the type of aircraft involved. He had a total of 5,565 hours, in DC-3 aircraft. His last en route check was on August 18, 1955, and his last proficiency check was on December 7, 1955. His last CAA physical examination was passed successfully on January 5, 1956.

First Officer Henry A. Schulze, Jr., age 34, held a currently effective airman certificate with an airline transport rating and equipment rating for the type of aircraft involved. He had a total of 6,020 flying hours, of which 2,958 hours were in DC-3 aircraft.

He passed his last instrument check on May 31, 1956, and last CAA physical examination on January 20, 1956.

AIRCRAFT

N 45V, a Douglas DC-3C, serial number 18984, had a total of 26,356 flying hours, including 9,318 hours since last major inspection. Time since last No. 2 line maintenance was 51 hours. The aircraft was currently certificated and properly maintained.

The aircraft was equipped with Pratt and Whitney R1830-92 engines and Hamilton Standard 25E30 propellers, with model 6353-18A blades.

WHO'S WHERE

(Continued from page 23)

Changes

John E. Harris, Jr., engineering representative (Washington, D. C. staff), Topp Industries, Inc., Los Angeles, Calif.

Aki Wakasugi, public relations representative (New York), Japan Air Lines.

D. W. Schult, administration manager, Lockheed Aircraft Service, Inc., Honolulu International Airport, Hawaii.

E. P. Heinemann, manager materials, General Electric's Light Military Electronic Equipment Dept., Utica, N. Y.

L. C. Arnold, Jr., manager-manufacturing, Epsco, Inc., Boston, Mass. Also **E. B. Haynes**, production manager, and **T. G. Hagen**, project engineer airborne data processing system.

Stanley G. Markusen, formerly public relations director (North America) for Sabena Belgian World Airlines, has formed Stan Markusen and Associates management consultants-public relations and sales (aviation and travel).

Walter T. Runiewicz, chief components engineer, and **William M. Dnowody**, chief systems engineer, Clifton Precision Products Co., Inc., Clifton Heights, Pa.

Robert M. Wilson, Washington, D. C. defense district manager, Defense Contracts Organization, Burroughs Corp., Detroit, Mich.

Dallas O. Burger, assistant project engineer (F-104), Lockheed Aircraft Corp., Burbank, Calif.

Allan B. Fredhold, plant manager, General Logistics, Pasadena, Calif.

Louis Shaffer, purchasing agent, the Marman Division, Aeroquip Corp., Jackson, Mich.

Louis Bucalo, assistant chief engineer, Specialties, Inc., Syosset, N. Y.

Robert R. Cole, chief design engineer, Axelson Aviation, Montebello, Calif. Also **D. E. Federson**, manager manufacturing engineering, and **J. D. Lezie**, factory manager.

Max Endelin, chief engineer (semiconductor division), Federal Telephone and Radio Co., Clifton, N. J.

Dr. Robert W. Buchele, staff administrator executive development and training program, Northrop Aircraft Inc., Hawthorne, Calif.

Dr. Tibor Laszlo, staff engineer-metallurgical research and development section, Wright Aeronautical Division, Curtiss Wright Corp., Wood Ridge, N. J. also **John H. Sidebottom**, director sales, Wright Aeronautical Division.

George H. Kelley, chief engineer, Southwest Airmotive, Dallas, Tex.

Thomas Nugent, district sales manager (Iran), Pan American World Airways, Inc. also **Frank Depaola**, station traffic manager (Paris), and **Frank S. Guzzardo**, assistant district traffic/sales manager (Rome).

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AVIATION WEEK has again been officially designated to publish "Air Transport Facts and Figures," compiled by the Air Transport Association. This editorial feature will appear in our April 22nd issue and will provide an impressive picture of the tremendous progress achieved by the carriers during the past year. We are particularly grateful that this vitally important editorial feature is again available to AVIATION WEEK's world-wide audience.

AVIATION WEEK average net paid ABC circulation June-December, 1956, **62,970.** Paid circulation of current issues, **65,726.** Recent readership research by Advertising Research Foundation shows 2.1 potential readers for every subscriber copy of AVIATION WEEK (readership determined by personal interview using strict recognition test). Current print order **69,817** copies.

Your advertising message scheduled for the April 22, 1957 issue will be timed to gain maximum attention from all those interested in the Air Transport industry. Regular advertising rates apply.

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LETTERS

". . . And Oh So Tall"

Many is the time that I have felt like doing this, but to this date have put off such projects. Now I can no longer resist. Today while reading the Letters to the Editor (AW Mar 11, p. 146), I came to one that I should have written in 1945. The title, "A Pox on Airlines," caught my eye. That poor, misguided individual has my sympathy.

When I was released from service in 1945 (I had many points, what with all the hero ribbons, etc.), I, too, decided that the airlines and I had something in common. I love and live to fly, and they needed experienced personnel. So, armed with my credentials and with a letter of recommendation from Col. Joe Duckworth, I sent applications to many, many airlines.

The answer was always the same. APPEARANCE! It didn't seem to matter that I had completed a tour of duty in Europe flying B-17s, checked out in all the fighter craft of the Air Force, or that I had been instructing at the Air Force Instrument Instructor's School at Bryan, Texas. (Very damn few were being released at that time with the total time that I had accumulated.) The only thing that seemed to matter was that I was only 5 ft. 6 in. tall and therefore, my appearance in the area of the cockpit would make the passengers feel insecure.

Ha! What laughs I have had since then to see some of these feeble old captains feeling their way down the aisle just because they are too darn proud to let any of the passengers see them wearing glasses. They are tall enough, mind you, but there it stops. Oh, yes, I almost forgot the pink cheeked youngsters following the captain—practically no experience, but boy, are they good looking, and oh, so tall!

Now, a word of advice to the "Military Pilot": Don't be discouraged, son. There are plenty of flying jobs around the country if you have the deep rooted conviction that you want to fly. I've done everything from instructing on the GI Bill to crop dusting, and at the present time I'm flying an Aero Commander for a corporation.

Maybe it's not the best flying job in the world, but at least I'm still doing what I've always wanted to do. I put the silver wings and the Distinguished Flying Cross in the dresser drawer, and maybe some day I'll show them to my grandchildren but that's about all they'll amount to. You and I, soo, are tall enough to go fight a war, but there's no one shooting at you when you make a position report to ATC, so whatever that quality is that allows us shorties to fly for the Air Force is not needed by the airlines.

A Pox On Them!

J. P. Shultz
York, Pa.

Fresh and Daring

Superior. Your magazine is just that and much more. As a flying safety engineer I run in a position to evaluate many publications that have my approval for dissemination to personnel under my charge. AVIATION WEEK has been and continues to be the most sought after magazine in the crew lounge. It offers what I think is a "professional" thought out edict that expresses aviation future as well as the present (man 1) state of the art. Your magazine offers to the military pilot what no "official publication" dares to print. That is the new trend in aeronautics which is fresh and daring.

Our magazines prescribed for combat crew reading include the USAF Flying Safety magazine and in our command SAC Combat Crew. Both of these magazines fall short of their goal in that they develop the dry technical orders into an editorial format. Your magazine tends to develop a thinking process and provoke thought rather than tend to Don'ts and Don'ts of flying engineering, or what have you. My personal backlog of old AVIATION WEEK magazines has long since disappeared from the crew lounge. Magazines as old as two years have had as much response as your latest edition. Your magazine, therefore, has given me the crux or lever to implement a strong accident prevention program in my unit by offering a fresh element that provokes thought along my flying safety goals.

While reading your magazine and digesting difficulties of the civil aviation authorities, I cannot help but wonder if the lessons learned in the past by others cannot lend themselves to the present. I have specific reference to the lack of do-nothing about the utility helicopter. Let me first cover the past.

After World War II I heard and read so much about civil aviation and the airplane in each man's back yard that I was ready with cash on the barrelhead to purchase a cheap aircraft. The junk that was dumped on the surplus market killed the idea before it was born. The L-2, L-5, PT-17, PT-19, BT-15, et al, required rework or modification, were too costly to operate, and the problems of maintenance were just beginning.

The folks looked forward, not to the fixed wing aircraft, but the rotary aircraft. The "chopper" manufacturers must have turned a deaf ear on the appeal of the common man who wanted a utility aircraft to travel back and forth to work, go for a short cruise on Sunday. In any event his radius of operation was about 100 or so miles. Was anything done about this demand? No. A costly and complicated product was developed for the military with no due regard for the wants of common man.

Today we are looking at a repeat of history. At least three helicopter manufacturers have designed and produced a unit capable of simplified operation and maintenance. There are an additional number of private individuals who have designed and flown one man helicopters capable of and within the limitations of the average man's ability to fly.

My question is, "Why hasn't a manufacturer offered to sell a one man helicopter or a utility helicopter?" My answer would be "No one has shown there is a market exists for the sale of this unit."

If CAA certification of a marketable product is in question then it is high time some pressure was brought to bear on the administration. If it is in the dark on helicopter operation then perhaps someone or certain groups should approach them and present the thinking of 1957 instead of 1930 fixed wing era.

I offer these comments as an expression of hope. Hope that your magazine would find it proper and timely to devote research into the matter and present an article to penetrate the thinking of certain responsible people.

I say the idea of a one man or utility helicopter in a man's back yard is real, not a dream. To prove my statement, I refer you to two newly developed one man helicopters. The first the Hiller XROE-1 is an American contribution designed for Marine Corps use as a one man helicopter. The second is the Dutch designed Kolibrie H-3 utility helicopter.

My point is if a farmer in the Netherlands can afford a helicopter why in blazes can't an American commuter be afforded an opportunity to purchase a like unit.

The Netherlands are ahead of us on this count—they have placed the helicopter in the hands of the ordinary citizen—a farmer. We in America cannot get the price below $10 000 for a similar unit.

Capt. R. C. Robson's article "Cockpit Viewpoint," gets a thorough going over by the crews in my unit. It is unfortunate you can not enlist the writing talents of some military pilot to enrich the "viewpoint" of civilian pilots and manufacturers. Beneath the surface of the military stirs a turbulent ebb that if brought to the surface would indeed awaken the minds of manufacturers, designers, engineers and the CAA.

Best wishes for a continuing excellent presentation of "the professional thought" in your magazine.

CAPT. EDWARD J. FRITZ, JR., USAF
Flying Safety Engineer

Easy On Freight

Regarding the editorial by Robert Hotz in the Jan. 7 issue p. 21, please be informed that an all air freight carrier such as Slick Airways would lose just as many shippers if we did as you say, "... kicking the passengers around like a freight shipment."

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